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THE Tramway & Railway World
A REVIEW OF CURRENT PROGRESS IN ELECTRIC AND OTHER TRACTION

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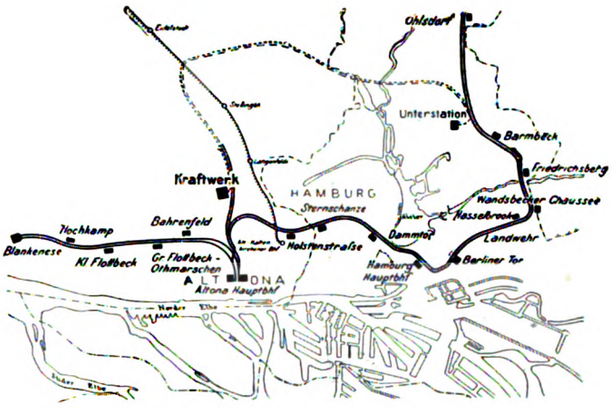
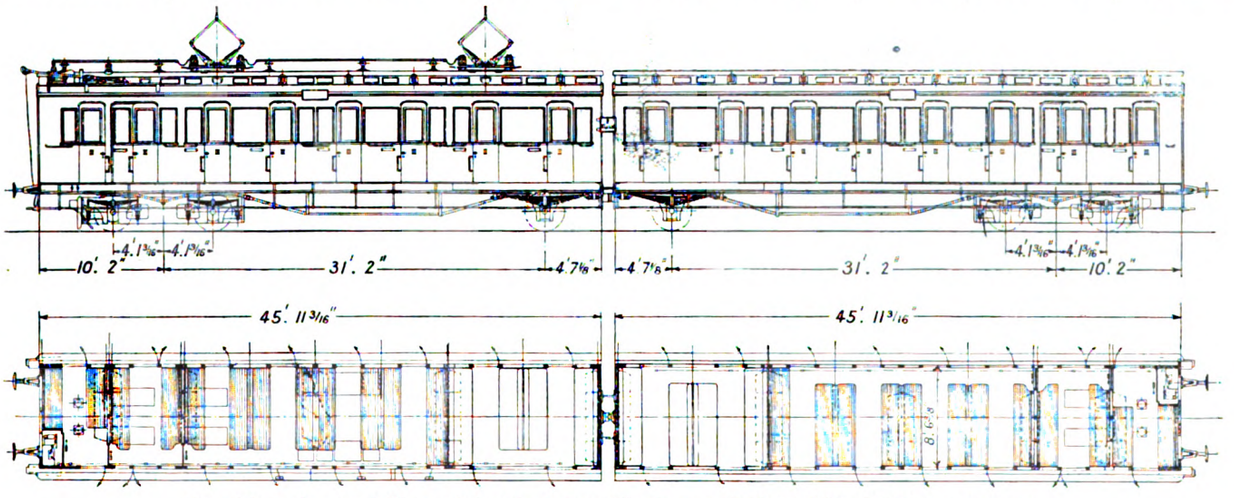
SOME CONTINENTAL SINGLE-PHASE RAILWAYS.

At the recent Congress of the German Tramway and Light Railway Association held at Berlin, M. Eichel contributed a long and interesting paper, giving an account of some of the single-phase electric railway installations which have been constructed in Europe within the past few years. He includes among them the Brighton Railway equipment, of which full particulars have been given in these pages from time to time (we may refer particularly to our issue of December 2, 1909), and the electrification of the Heysham line of the Midland Railway, which was fully described in our issue of June 4, 1908. Among the other electrified lines to which M. Eichel refers, those of the Blankenese-Ohlsdorf and the Niederschoneweide-Spindlersfelde Railways are of particular interest.



Map of Blankenese-Ohlsdorf Single-Phase System.

Influenced by the satisfactory results obtained in 1907-8 from the latter, the Prussian State Railways constructed and put in operation the urban and suburban system known as the Blankenese-Ohlsdorf line. From the terminus at Blankenese this line extends eastward to Altona. From this point the line runs north to Kraftwerke, and another line eastward passes through Hasselbrooke, and then turns northwards through Friedrichsberg to Ohlsdorf. At the outset the rolling stock consisted of 60 motor carriages, 54 of which were constructed by the Allgemeine Elektricitäts-Gesellschaft, and six by the Siemens-Schuckert Company. In the summer of 1908 this stock was supplemented by the addition of 17 Allgemeine Elektricitäts-Gesellschaft cars, and eight Siemens-Schuckert cars, and by the end of 1912 the undertaking possessed 140 motor cars. The central station has a capacity of 8,750 KW. in 6,300 volt single-phase machines. The generators and switchboards were supplied by Siemens-Schuckert; the turbines, with their auxiliaries, by Brown Boveri, while the small dynamos for electric lighting and power were constructed at the shops of Felten-Guilleaume-Lahmeyer. The central station is equipped with seven turbo-generators running at 1,500 revolutions per minute and producing single-phase current at 6,860 volts and 25 cycles. The Siemens-Schuckert dynamos are capable of an overload for a short period of 700 KW. They are driven by Brown-Boveri-Parsons turbines. Such current for lighting as is required is produced by a turbo-generator of 600 KW. at 6,300 volts and 50 periods, and there are two Felten-Guilleaume-Lahmeyer groups producing either continuous or three-phase current at 50 volts. The trains, which are operated on the multiple-unit system, include a certain number of trail cars. The electrical



Side Elevation and Plan of Carriages on Blankenese-Ohlsdorf Single-Phase System.

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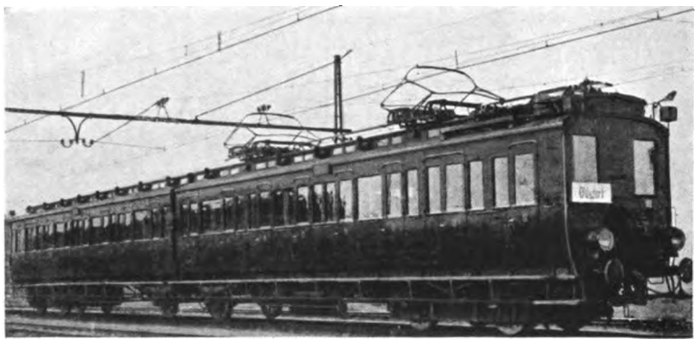
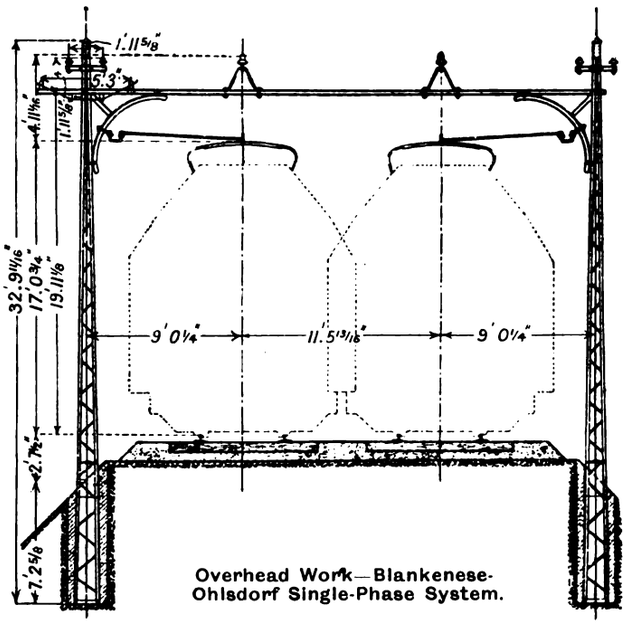
equipment of the motor cars consists of two motors, each of 200 H.P. The catenary suspension as designed by Siemens-Schuckert has been installed, and consists of lattice poles erected on either side of the tracks, supported by transverse girders.

As a typical example of the work which the installation is capable of doing, it may be recalled that on August 28, 1911, the day of the Imperial Review, a service was given aggregating 19,716 car-miles, which compares with 11,000 car-miles, the ordinary day's work. On the day in question the total number of passengers carried was not less than 300,000, and, at that time, the tracks were not yet constructed in such a way as to enable the double track of the through lines to be fully brought into service. With the installation at that time a service of only eight trains per hour could be given, as compared with 18 trains per hour at present. With the steam trains the maximum number of passengers transported reached 5,000 per hour, as compared with 20,000 carried by electric traction. For comparison it may be mentioned that in 1904 on the day of the Imperial Review at Altona, with steam traction, the service amounted to 1,556 train-miles.

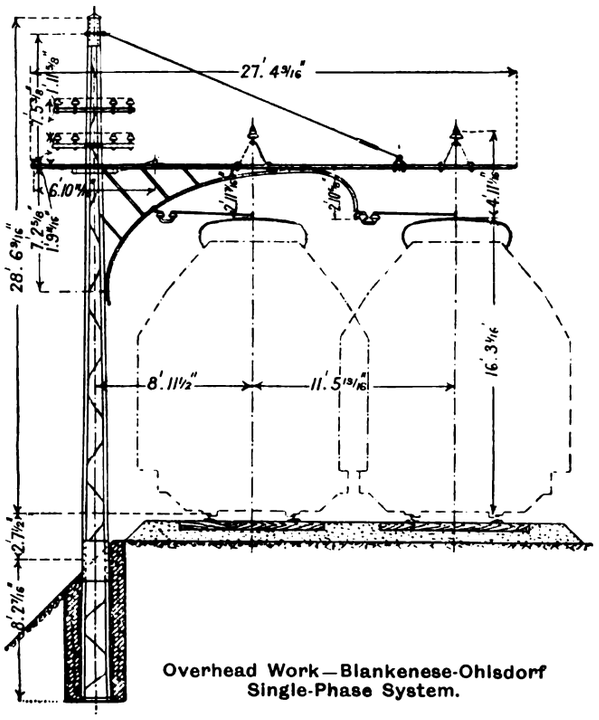


Motor Car and Trailer—Blankenese-Ohlsdorf Single-Phase System.

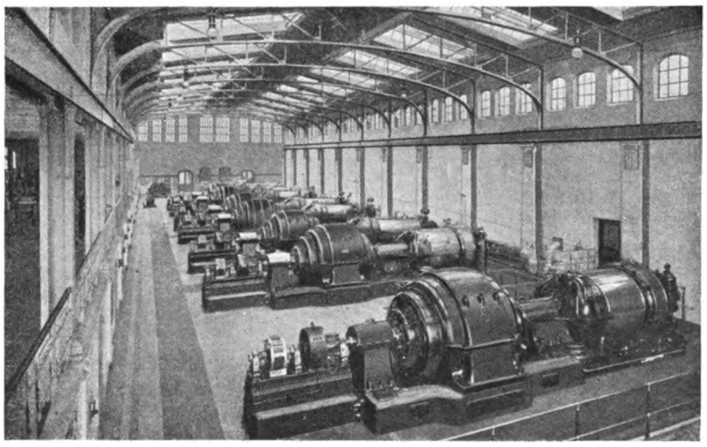
Reverting now to the single-phase system, we find that the years 1907 and 1908 were marked by considerable projects of railway electrification on this system in Holland, in England, and in Italy. In the former country, on October 1, 1908, the Siemens-Schuckert shops completed for service the Rotterdam-La Haye-Scheveningen Railway, which is a standard gauge line. The trains on this line consist of four carriages. The motor cars are of two types, one having seats for 24 second-class passengers, 49 third-class, and standing places for 14 passengers on the platform. The other has seats for 46 passengers, and standing places for 14 second-class passengers. The bodies are 17·27 metres in length, and are carried upon two bogies. The electrical equipment consists of four single-phase motors worked in series, of the Siemens-Schuckert type, each having a capacity of 175 H.P. At the preliminary trials of the line, a speed of 100 kilometres per hour was attained. The motor cars weigh 51 tons, and the trailers have seats for 88 passengers, standing room for 20 others, and weigh 31 tons. The energy for this line is supplied from its own single-phase station at 10,000 volts, 25 periods. The service is performed by trains controlled on



Overhead Work—Blankenese-Ohlsdorf Single-Phase System.



Overhead Work—Blankenese-Ohlsdorf Single-Phase System.



Power-Station—Blankenese-Ohlsdorf Line.

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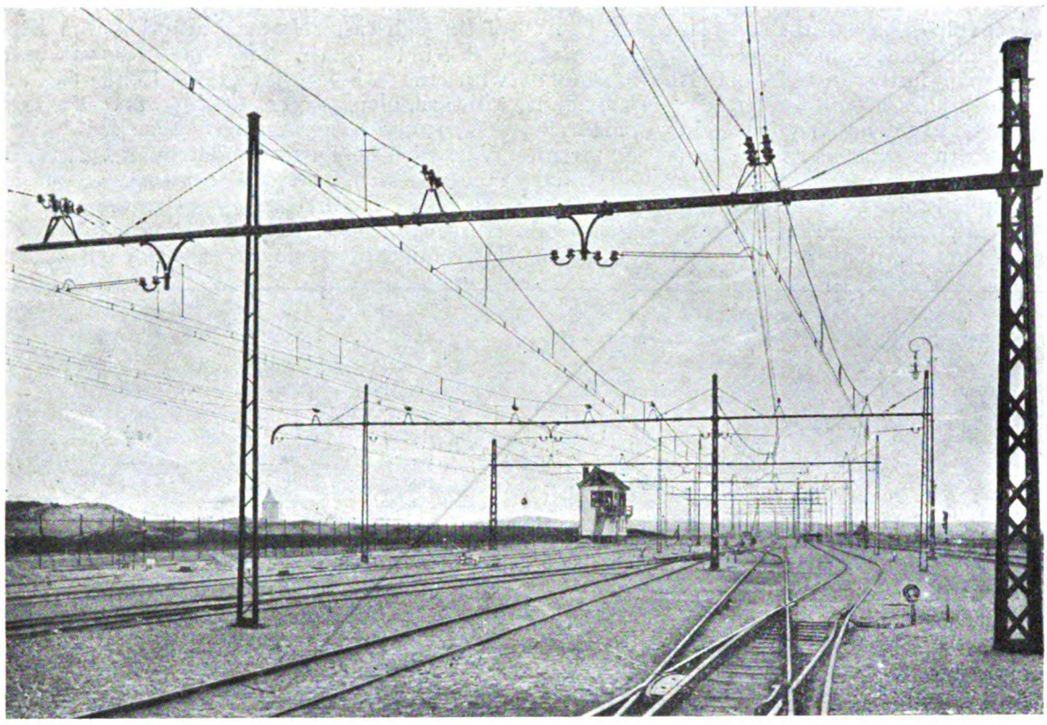
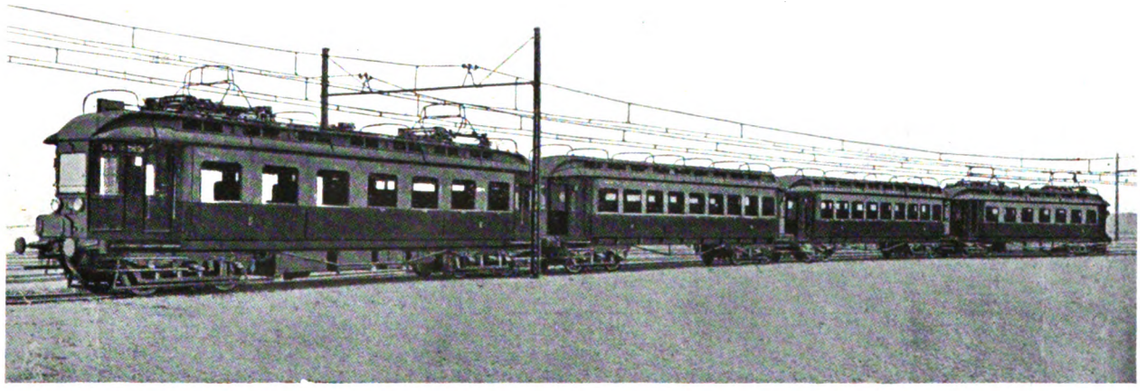
the multiple-unit principle, each motor car weighing 51 tons. The trains consist of one or more motor cars and one or two trail cars.

As upon other railway lines in Holland, the overhead work for this line at the outset gave rise to considerable difficulties, owing to the frequent subsidences due to the marshy land. Moreover, the overhead system being complicated, it was difficult to insulate satisfactorily, on account of the very unfavourable climatic conditions, and especially the humidity of the atmosphere charged with marine salt. Finally, the constantly moving sand dunes, the grains of which acted as an abrasive agent, created numerous complications both from the mechanical and electrical point of view. But all these obstacles were rapidly overcome, and the line to-day carries a very dense traffic, especially in the summer months. The normal speed of 60 kilometres per hour is extremely high, considering that the average distance between stops does not exceed 2·75 kilometres. Consequently the motors have to do the work of acceleration in a very brief interval. In spite of these high speeds, the supply of power is provided very efficiently, thanks to the careful construction of the overhead lines and the contact appliances. The suspension of these lines, as on the Blankenese railway, is carried out on the Siemens-Schuckert catenary system, with double lattice poles and transverse girders. The length of the girders at certain points, notably for instance at the entrance to the station at Scheveningen, is very great, in order to provide for the numerous tracks.



Catenary Suspension on Rotterdam-La Haye-Scheveningen Single-Phase System.



Four-Car Train on Rotterdam-La Haye-Scheveningen Line.

Enterprise at Cardiff.—In view of the intention of the Corporation to promote a Boundaries Extension Bill, Mr. A. Ellis, the tramways manager, recommends that powers be obtained for the running of petrol-electric omnibuses and railless trolley cars.

More P.A.Y.E. Cars for Aberdeen.—The Tramways Committee recommend that powers be given to alter three of the present cars by converting them for P.A.Y.E. operation, at a cost of £20 each. Ten such cars are to be run on the Woodside route.

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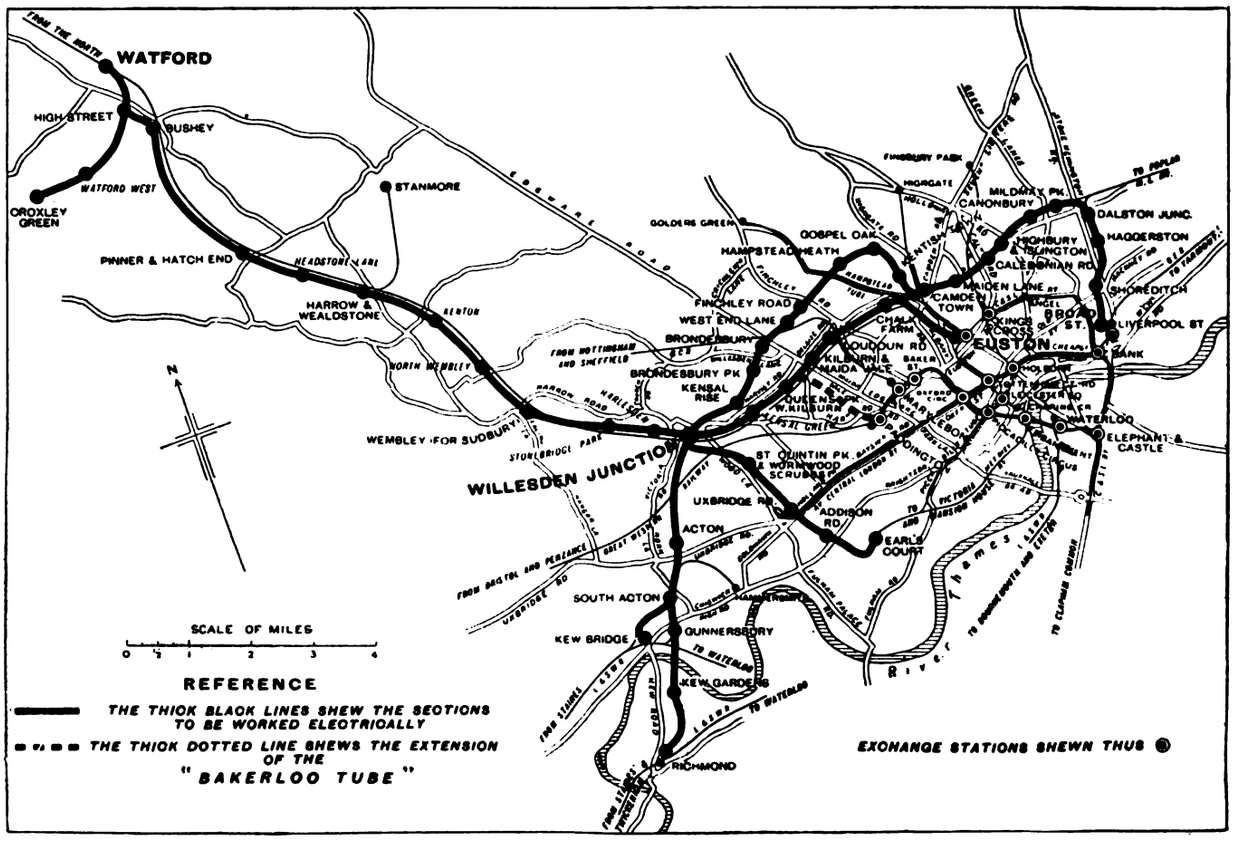
THE LONDON AND NORTH WESTERN RAILWAY ELECTRIFICATION SCHEME.

In our issue of December 7, 1911, we published a full description of the routes on the London and North Western Railway and allied lines in and near London, which are to be converted to electric traction under the scheme which the railway company are carrying out. We are now enabled, through the courtesy of Mr. F. A. Cortez-Leigh, chief electrical engineer to the railway company, to give further details. In the following description the routes are only referred to briefly, and attention is given to the power plant and equipment.

The electrification scheme will mark an important step in the conversion of the suburban lines round London. Not only does the scheme provide for the electrification of 79 miles of track, hitherto operated by steam traction, but it will also enable electric trains to be worked by a main line company over one of London's "tube" railways, namely the Baker Street and Waterloo. This is an innovation which will, no doubt, have considerable influence in inducing other main line companies to undertake similar electrification work.

The present scheme dates from the Act obtained by the London and North Western Railway Company in 1907, which authorised the construction of a new line from Euston to Watford running alongside the main line, and is intended to relieve the latter of its suburban traffic. The scheme now includes not only the original proposal, from Euston to Watford, but also the electrification of the North London Railway from Broad Street to Chalk Farm, and the London and North Western Railway from Camden Town, *via* Hampstead, to Willesden (High Level) and thence over the West London and District lines to Earl's Court, and also from Willesden over the North and South Western Junction and London and South Western lines to Kew Bridge and Richmond. The whole scheme is shown on the map here reproduced. The extension of the "Bakerloo" Railway will join the London and North Western Company's Euston to Watford line at Queen's Park, where the "tube" will rise to the surface and make a physical connection with the London and North Western main electric line. The scheme will therefore give facilities for the running of through trains from Watford to the Elephant and Castle in the south, and a connection will be established with the whole system of London's underground railways, giving access to all parts of the metropolis.

The civil engineering work of the new line to Watford is being carried out by Mr. E. C. Trench, the company's engineer, and this section is making great progress, the first portion, between Willesden and Harrow, having already been opened for traffic in June last and is now being operated by steam trains. This section will be extended to Watford about the beginning of February.



Electrification Scheme of the London and North Western and North London Railways.

The equipment of the line for electrical working is now about to be undertaken, but the first section over which electric trains will operate will be from Willesden over the West London line to Earl's Court, and it is expected that these trains will be running very shortly. The system of electrification to be adopted for this important undertaking has received very careful consideration by the company under the advice of their chief electrical engineer, Mr. F. A. Cortez-Leigh, and it has now been decided to adopt a continuous-current system at 600 volts for the operation of the trains, using "third" and "fourth" rails in accordance with the system already adopted by the Metropolitan District Railway and other London lines over which the company's trains will run, which system leaves the track rails free for the installation of track-circuiting and automatic signalling.

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The London and North Western Company are already inviting tenders for some sections of the electrical equipment to the specifications of the chief electrical engineer, who has entire charge of all this work, and who is very busily engaged in preparing all the necessary plans, and it is hoped that all the most important contracts for this work will be placed early in the new year. The general manager, Sir Frank Ree, is, of course, taking a very keen interest in the work which is being carried out under his personal supervision.

The power-station will be erected between Stonebridge Park and Wembley stations on a site covering an area of 17 acres adjacent to the electric line. The power-station buildings are being so laid out that if necessary the power-house can be considerably extended, and special consideration has been given to the important question of storing a large quantity of coal, space being available for many months' supply. Further, a good supply of water is obtainable on the site.

The very up-to-date and excellent coal handling arrangement which will be provided enables no less than three months' supply to be handled automatically, utilising the old coal first, and after considering many proposals, Mr. Cortez-Leigh, in consultation with Sir Alexander Kennedy, the eminent electric power expert, decided to recommend this system. The necessary railway siding accommodation, which will be provided in the arrangements for dealing with the coal, is such that two trains can be discharged in a few minutes, and the system also lends itself readily for the convenient removal of ashes from the power-house to the trucks in the sidings. In addition to the reserve of coal outside the power-house, storage bunkers will be provided as is usual above the boilers, and will be filled by mechanical elevators and conveyors.

The power-house will be a very substantial structure, and the initial plant will have a capacity of about 25,000 KW.; it will consist of turbo-generators having a large overload capacity, and will be complete with the usual complement of boilers, mechanical stokers, condensing plant, etc. The whole of the generating plant will be of the most up-to-date and economical design, and will be so arranged that any unit can be taken out of action without interfering with the working of the station. Duplication and other provision for emergencies has been allowed for as far as possible to ensure continuity of supply. Similar provision will also be made in the main conductors to the sub-stations and from the sub-stations to the conductor rails on the track.

The electrical energy will be generated at 11,000 volts, three-phase alternating current at 25 cycles per second, and will be transmitted by cables carried on each side of the line to sub-stations located from three to four miles apart. The cables will be entirely in duplicate, and so placed as to be well out of the way of interference from traffic operation, and where possible they will be carried above ground. At the sub-stations the current will be converted from the high-tension three-phase supply to direct current at 600 volts by means of static transformers and rotary converters in the usual manner, and transmitted direct to the conductor rails. In addition to the transforming plant the sub-stations will be equipped with large storage batteries and automatic boosters, which alone will be capable, if necessary, of running a full service of trains for a considerable time. The batteries will also be of service in relieving the power-house of the heavy peak loads incidental to the operation of electric trains.

The site obtained for the erection of the power-house will also provide ample accommodation for the shed for repairing and overhauling the electrical equipment, and as the position is approximately in the centre of the system, it will tend to reduce dead mileage, and also facilitate the handling of the trains generally. Further, this will enable the administrative work to be centralised, and thus obviate duplication of supervision.

The rolling stock will be of the most modern type, and will consist of motor cars, trailers, and driving trailers, and every consideration has been given to the seating accommodation, lighting, heating, etc., to ensure the maximum of comfort for passengers. The trains will be operated by the multiple-unit system, so that they may be driven from either end, and can be made up in units of such number of coaches as may be required to suit the conditions of the traffic. The number of motor cars required for the proposed service will be about 100, and during the busy hours it is proposed to run a service with five minutes' intervals between trains on the Watford section of the line. The electrical equipment will be of the four-motor type, with motors of large capacity, as it is intended to operate at a high schedule speed, and with an acceleration second to none in the country. The stock for working over the Bakerloo "tube" will be of special design, as it is necessary to bring this within the limits imposed by the diameter of the "tube," and also to allow for the difference in the heights of the platform levels.

It is expected the company's power-station will be ready for the supply of current in about two years' time.

The London and North Western Railway Company in embarking on this undertaking have left no stone unturned to give to the public the most up-to-date system which engineering science can produce, in every respect suitable to the local conditions, every point having been most carefully considered with this object in view.

RAIL CORRUGATION.

At a meeting of the Institution of Municipal and County Engineers held at Caxton Hall, London, on December 6, Mr. H. T. Wakelam, engineer to Middlesex County Council, presented a paper on his tabulation of the replies received to queries sent out by the Tramways Committee of the Institution on the subject of rail corrugation. Mr. Wakelam thought that the replies received made it abundantly clear that corrugations are not caused by electrolytic action, rolling stock (*per se*), driving and braking, soft rails, or resilient tracks; and that whatever the real cause may be it is aggravated by impact and vibration, hard rails, rigid beds, and curvature. The discussion was taken part in by Messrs. M. Hainsworth (Teddington), W. Fairley (Westminster), W. J. Hadfield (Sheffield), W. Harpur (Cardiff), R. B. Holt (permanent way engineer to Leeds Corporation), J. C. Radford (Putney), and J. W. Cockrill (Great Yarmouth). An interesting announcement, made by Mr. Wakelam, was that on a London tube railway, which had a centre-supported track, there had been no sign of corrugation in six years, and owing to the successful results obtained as against tracks on rigidly supported beds, the author understood that it is the intention of the engineer of another railway to reconstruct the whole of the system of which he has charge on the centre-supported plan. Mr. Wakelam urged that the subject of corrugation had got into the state which resolved itself into one thing, that all the information should be sent to Dr. Glazebrook at the National Physical Laboratory at Teddington, where they could carry out comprehensive tests and researches. To tramway companies and to corporations he would say that money spent in connection with researches by Dr. Glazebrook would be well spent.

Additional Plant for Stalybridge Tramways and Electricity Board.—Application is to be made to the Local Government Board for powers to borrow £20,000 for additional plant at the generating station of the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board.

Question of Purchasing Bristol Tramways Company's Undertaking.—The City Council have directed a special committee to consider and report as to the desirability or otherwise of exercising the option vested in the Corporation of purchasing the tramway undertaking. The option cannot be exercised until half-way through the year 1916.

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SUCCESS OF PETROL TRAMCARS AT KARACHI

The report submitted to the annual meeting of the East India Tramways Company, held in London on December 16, and the remarks of the chairman, bring out clearly the highly and increasingly favourable financial results obtained from the use of "Simplex" petrol cars on the company's tramways in Karachi. The report showed that the receipts for the year were £19,533, against £14,754 in the previous year, and the expenses were £10,993, against £10,184. Out of the surplus, £3,495 was carried to suspense account, and the balance of profit was £5,045, against £3,452. The profit enables the payment of a dividend of 5 per cent. on the cumulative preference and ordinary shares, and 10 per cent. on the deferred shares. The following passage is extracted from the report:

"This continued improved result is very gratifying; and although the doubling of the track and the prosperous trade of Karachi have assisted materially, there is no doubt it is principally due to the 'Simplex' motor traction, which was commenced experimentally during 1909, and has since last February entirely superseded the horse traction, with great success in popularity and economy. The main feature of the motor traction is the low operating costs, which for 46-seat motor cars now averages only 1·50d. per car-mile for power, repairs, and maintenance, compared with 3·02d. per horse-car-mile expenses for working cars of 30-seat capacity. This conjoined with the exceptionally low fares in vogue (as low as ¼d.), averaging less than 1d. per passenger, is all the more notable. In view of the above-mentioned low operating costs, extensions for development of outlying districts equal to about three miles are contemplated, and will be undertaken as soon as the necessary preliminary arrangements are completed. These extensions will later on involve the necessity of a further issue of capital."

The Chairman, in the course of his speech, said: The low record cost of 1½d. per car-mile for power, maintenance, and repairs of "Simplex" motor trams carrying 46 passengers, comparing with over 3d. for the 30-seat horse cars formerly, has more than equalled the most sanguine expectations of the board. At the same time the new system has obtained such material increase of traffic as was anticipated, and as usually does follow a more speedy and regular service. In this connection it is encouraging to hear from outside sources that the motor trams at Karachi, while quite as speedy, run more quietly and with less vibration than average electric tramcars do, which, besides being agreeable to passengers renders them lighter on the permanent way. Such low operating costs have influenced the directors in the contemplation of making extensions for the development of outlying districts, of about three miles in length, and estimated to cost about £5,000 to £6,000. To provide for such extensions, and for readjustment of the capital account (owing to the reserve and suspense funds having been expended upon the Frere Street extension, main line doubling, and the new motor traction equipment) a resolution will after this general meeting be proposed for the creation of 20,000 new deferred shares for issue to existing deferred shareholders as may from time to time be deemed advisable by the board, in substitution of those funds, which are no longer available. Shareholders will be glad to know that the current year's receipts continue to improve, being for the past four months £7,688 compared with £5,708 for a similar period of last year, when some of the horse cars were still in operation. So far, therefore, prospects for the ensuing year are decidedly hopeful.

To the chairman's remarks may be added the following, as showing in convenient and brief form some of the leading facts of the Karachi experiment and claims put forward on behalf of the "Simplex" system:

(1) After three years' working of "Simplex" motor tramcars at Karachi they are still found to be satisfactory.

"Simplex" Petrol Cars on the Karachi Lines of the East India Tramways Company.

(2) The cost for power, maintenance, and repairs was 1½d. per car-mile only.

(3) The total operating costs, including ·98d. for depreciation, were just over 4½d. per car-mile.

(4) The receipts were 9·05d. per car-mile.

(5) The actual total receipts of the company were £19,533, and the expenses £10,993, and profit £8,540.

(6) The "Simplex" system can be installed for about one-fifth of the cost of an electrical undertaking.

(7) The operating costs are materially less than for electrical traction.

(8) The Baroda Tramway Company, after carefully inspecting the "Simplex" system at Karachi, are replacing their horse cars with "Simplex" motor cars.

(9) Other Indian tramways, in view of the success at Karachi and the profits received, are now considering the adoption of "Simplex" tramcars.

(10) Outside opinion confirms the fact that the cars run easily and quietly.

(11) The fact that native drivers manage the cars speaks well for the simplicity of the system.

Tramcar Vacuum Snow Sweeper.—Representatives of some 70 local authorities witnessed demonstrations given at Southport by the patent motor vacuum road-cleaning machine (sweeper and gatherer), of which Messrs. J. and P. Hill, Ordnance Works, Sheffield, and Caxton House, Westminster, hold the patent rights. The mechanism can be applied to a tramcar for sweeping snow from the track. An exhibition of the machine is to be given in London. An Italian engineer is the inventor, but Messrs. Hill will produce a machine of British manufacture, with developments and improvements to meet the needs of different towns.

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SPECIAL TRACKWORK CALCULATIONS.

By Ernest Larmuth.

The writer has often been asked to explain his methods of calculation, and the following notes are written in the hope that they will prove to be of service to those interested in tramway trackwork. Whilst possibly not covering every conceivable problem, the examples are sufficient to cover most of the problems likely to require solution by permanent way engineers. The calculations necessary for the solution of problems in special work for tramways do not require a deep knowledge of mathematics so much as a thorough training in a few elementary principles, and also the ability to see how and where these principles apply.

Examples I., II., III. will cover practically all that is required where the main tracks are both straight. Examples IV. to VIII. refer to problems in which it is necessary to comply with special conditions, such as working to existing curve tracks, curved main tracks, etc. The part of these notes on reverse curves is relatively simple, but it has been included in order to make the treatment of the subject more complete. In the diagrams and explanations the use of definite examples has been avoided, the object being to make the formulæ as general as possible.

Each example should be carefully dealt with by actual calculation, and afterwards checked by drawing to scale. By so doing, far more benefit will be obtained (through failures caused by laying down impossible conditions) than by merely checking figures which have been previously worked out.

Example I.—(Fig. 1.) *Plain Curves.*

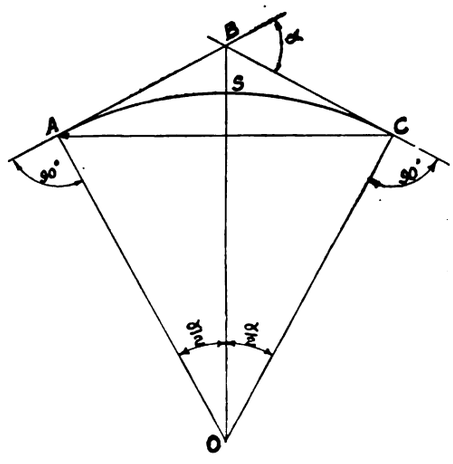


Fig. 1.

The calculations for circular curves connecting two intersecting lines present no difficulty:

$$AO = CO = R.$$

$$AB = BC = \text{Tangent} = R \tan \frac{\alpha}{2}.$$

$$AC = \text{Chord} = 2R \sin \frac{\alpha}{2}.$$

$$BS = \text{Exsecant} = R \sec \frac{\alpha}{2} - R.$$

When, however, compound curves have to be dealt with, the problems are not quite so simple. By the term "compound curve" is meant a curve (connecting two intersecting lines) which is not of uniform radius throughout. There is usually, however, a central portion of the curve which is of uniform curvature, and the radius of this portion is generally termed the radius of the curve. The central radius is also, generally speaking, the minimum radius on any curve.

The remainder of the curve may be composed of one or more sections of varying radii, forming spirals or easement curves. In whatever manner the curve is built up, the first operation, where possible, is to determine the co-ordinates of the centre of the main curve. These can be denoted by the letters x y.

Methods of calculating the co-ordinates x y are given below:

Let Rr (Fig. 2) be the radii of the curves,
Then $(R - r) \sin \alpha = y$.
$R - (R - r) \cos \alpha = x$.

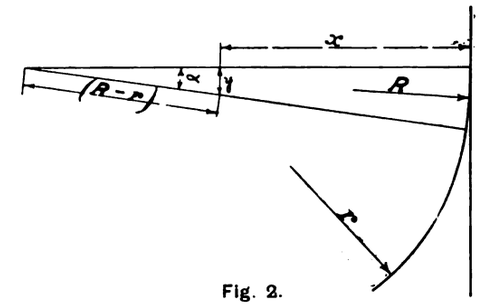
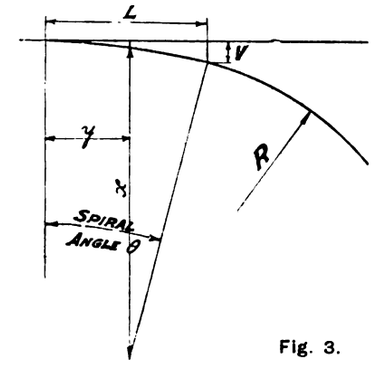


Fig. 2.

If two or more curves intervene between the straight line and the central curve, the above operation can be repeated until the co-ordinates for the centre of the main curve are obtained.

If a circular arc is to be fitted to the end of a spiral curve, details of which are known, the following will give the required co-ordinates (Fig. 3):



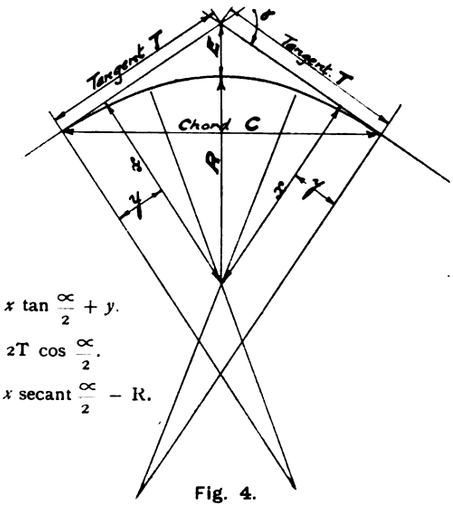
Values of $LV\theta$ are given in the details of spiral.

$y = L - R \sin \theta.$

$x = V + R \cos \theta.$

Fig. 3.

Example II.—(A) In cases where the curve is symmetrical, *i.e.*, the co-ordinates referred to each tangent line are the same, the following formulæ will give all the information that is required (Fig. 4):



$$\text{Tangent} = T = x \tan \frac{\alpha}{2} + y.$$

$$\text{Chord} = C = 2T \cos \frac{\alpha}{2}.$$

$$\text{Exsecant} = E = x \operatorname{secant} \frac{\alpha}{2} - R.$$

Fig. 4.

The co-ordinate x is usually calculated to the gauge line, and as used above would give tangent lengths

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from gauge line intersections. If it is desired to obtain lengths from the intersections of any other lines (say centre lines of track) to the tangent points of the curves, the x dimension will require to be increased or decreased accordingly, but the y dimension will remain unchanged.

EXAMPLE III.—(B) In cases where the curve is not symmetrical with relation to both lines, the following is, in the writer's opinion, the quickest and simplest of several solutions.

[NOTE.—The want of symmetry may be caused by alterations in width of centre-way or altered position of one track. It is also sometimes necessitated by some condition limiting the design in a new lay-out.]

Let XY xy be the co-ordinates to the two tangent lines, and let angle of intersection $= \propto$ (Fig. 5).

(a) Then $AB = x \tan \frac{\propto}{2} + (X - x) \operatorname{cosec} \propto + y$.

(b) $BC = x \tan \frac{\propto}{2} + (X - x) \operatorname{cotan} \propto + y$.

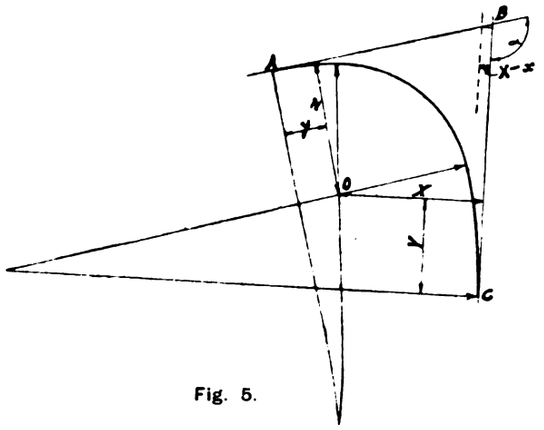

Fig. 5.

Having thus obtained the tangent lengths, there is no difficulty in calculating the chord length AC and the distance BO from which the exsecant can be obtained.

This method is extremely useful in calculating dimensions relating to track centre lines where the distances from centre to centre of tracks are not alike on two roads, although the curve itself is symmetrical with respect to gauge lines.

In equation (b) the $+^{ve}$ sign before the second member will become negative when $\propto$ is less than 90°.

The following examples are much more complicated, but are of especial value where new track is required to connect to existing curves.

EXAMPLE IV.—(1) To connect a straight line and a curve at a given point by a uniform circular curve (Fig. 6).

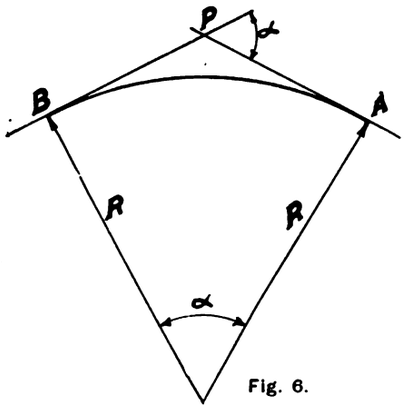

Fig. 6.

Let PB be the straight line.
PA the tangent to curve at A.
Angle BPA $= (180° - \propto)$.

Then $R = PA \operatorname{cotan} \frac{\propto}{2}$

$BP = PA$.

EXAMPLE V.—If, however, a compound or spiralised curve is required, the solution is a little more difficult. (Figs. 7 and 8).

Having decided on the spiral to be used, and determined $LV\theta$, the first operation is to determine the tangent lengths to the spiral.

These are given by the following equations:

$AB = L - V \operatorname{cotan} \theta$.

$BC = V \operatorname{cosec} \theta$

E = junction of new and existing curves.

AP and PE are tangents to curve required.

$\propto$ = angle of intersection.

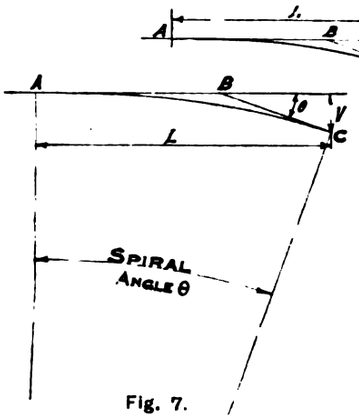

Fig. 7.

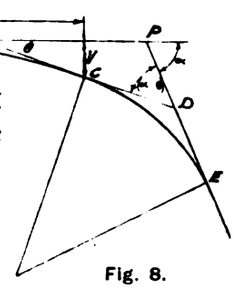

Fig. 8.

Required to find radius of new curve:

Let $PE = Z = PD + x$ where $DE = x = CD$.

$PD = BD \frac{\sin \theta}{\sin \propto} = (V \operatorname{cosec} \theta + x) \frac{\sin \theta}{\sin \propto}$.

$PE = Z = (V \operatorname{cosec} \theta + x) \frac{\sin \theta}{\sin \propto} + x$.

$x \left(1 + \frac{\sin \theta}{\sin \propto}\right) = Z - V \left(\frac{1}{\sin \propto}\right)$.

$$x = \frac{Z - V \operatorname{cosec} \propto}{\left(1 + \frac{\sin \theta}{\sin \propto}\right)}.$$

$R = x \operatorname{cotan} \left(\frac{\propto - \theta}{2}\right)$

$BP = BD \frac{\sin (\propto - \theta)}{\sin \propto} = (V \operatorname{cosec} \theta + x) \frac{\sin (\propto - \theta)}{\sin \propto}$

Tangent length AP = AB + BP.

$$= L - V \operatorname{cotan} \theta + (V \operatorname{cosec} \theta + x) \frac{\sin (\propto - \theta)}{\sin \propto}$$

The result of the last equation can be checked by calculating the co-ordinates for the radius R determined and then calculating the tangent lengths as previously described. (See Example III.)

EXAMPLE VI.—(2) Given one tangent length and position of centre of main curve, to determine the other tangent length for given radius to connect to main curve (Fig. 9).

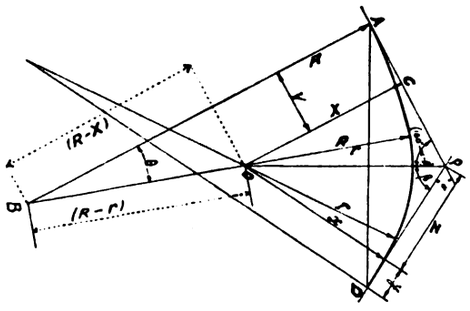

Fig. 9.

Given z, y, x, r, R, $\propto$ to determine XY and tangent length PA.

$\frac{x}{z} = \tan \beta$.

$x \operatorname{cosec} \beta = PO$.

$(x \operatorname{cosec} \beta) \sin (180 - \propto - \beta) = CO = X$.

$(X \operatorname{cosec} \beta) \cos (180 - \propto - \beta) = PC$.

Then $\frac{R - X}{R - r} = \cos \theta$

$(R - r) \sin \theta = Y$.

$PA = PC + Y$.

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Knowing the position of centre O with relation to P it is an easy matter to calculate the exsecant.

The chord length AD is calculated from the triangle APD, of which we now know AP, PD, and angle APD.

EXAMPLE VII.—(3) The next example with which I propose to deal is to connect two curves by means of a curve of different radius, being given the tangent lengths and angle, also the radii of the three curves (Fig. 10):

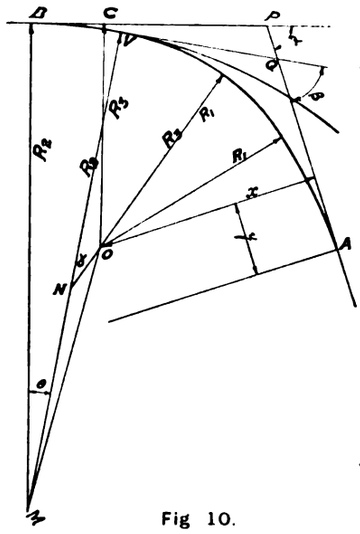

Fig 10.

Given PA, PB, x, y, R_1, R_2, R_3 to find θ, γ, β.

From PA, x, y calculate PO, CO, PC (see Example VI.).

Then $\frac{PB - PC}{R_2 - CO} = \tan BMO$.

$(R_2 - CO)$ secant $BMO = MO$

$MN = R_2 - R_3$.

$NO = R_3 - R_1$.

From the three sides MN, NO, MO the angles can be calculated.

Then $\angle BMO - \angle NMO = \theta$.

$180 - \angle ONM = \angle NOM + \angle NMO = \gamma$.

$\beta = \alpha - \theta$.

Having determined the angles, it is now a matter for straightforward calculation to determine the new tangent length QV, and any other details (chord, exsecant, etc.) which may be required.

EXAMPLE VIII.—(4) The next case to be dealt with is a curve connecting two main tracks—one of which is curved (Fig. 11).

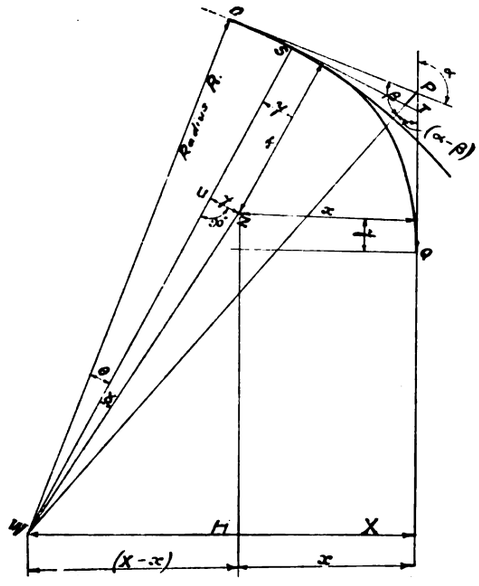

Fig. 11.

Let OP, PQ represent the two tangents intersecting at P.

Let α = angle of intersection.

Let O = tangent point to radius R.

Assume the connecting curve to be symmetrical radius r spiralised or compounded at ends.

Let x y be co-ordinates to centre of connecting curve from tangents ST and PTQ.

Let S = Point of contact of two curves.

W = Centre of curve radius R.

Then SW = R.

SU = x.

UW = R − x.

UZ = y.

$\tan \gamma = \frac{UZ}{UW}$.

ZW = UW sec γ.

To determine angle θ.

$\frac{OW}{OP} = \frac{R}{OP} = \tan \beta$.

OW cosec β = PW.

Let X = perpendicular distance from W on line PQ extended.

X = PW sin $(\alpha - \beta)$ = OW (cosec β) sin $(\alpha - \beta)$.

Draw ZH parallel to PQ.

Then $\frac{(X - x)}{ZW} = \cos \angle ZWH$.

Angle HWO = $180^\circ - \alpha = \theta + \gamma + \angle ZWH$.

$\theta = 180^\circ - \alpha - \gamma - \angle ZWH$.

Knowing the angle θ we are now able to determine the position of the point S and direction of the tangent to the curve at S, and the calculations resolve themselves into those for a symmetrical curve as previously given. (Example II.)

EXAMPLE IX.—*Reverse Curves.* It is sometimes necessary to use a reverse curve on tracks where the centre line is moved parallel to itself. There are three or four cases, which may be considered as typical.

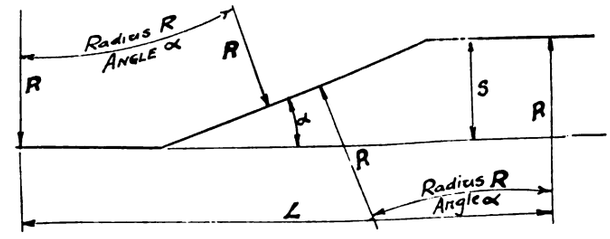

Fig. 12.

(1) Ordinary reverse curve with portion of straight track in centre (Fig. 12).

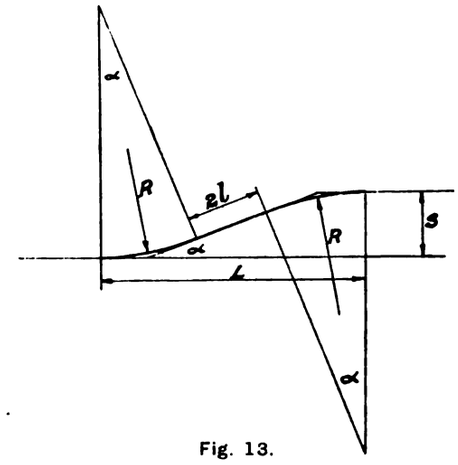

Fig. 13.

Where L is not fixed, radius R and angle α can be decided upon. Length L is given by the following equation:

$$L = 2R \tan \frac{\alpha}{2} + S \operatorname{cotan} \alpha.$$

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EXAMPLE X.—(2) Assume the length L to be fixed and also the length of the straight ($2l$) it is desirable to have in centre to find R and $\propto$

The distance between the two centres $= 2\sqrt{R^2 + l^2}$

Then $(2\sqrt{R^2 + l^2})^2 = L^2 + (2R - S)^2$

$$4R^2 + 4l^2 = L^2 + 4R^2 + S^2 - 4RS.$$

$$R = \frac{L^2 - 4l^2 + S^2}{4S} \quad (1).$$

$$\propto = \frac{-1}{\cos}\frac{2R - S}{2\sqrt{R^2 + l^2}} - \frac{-1}{\tan}\frac{l}{R} \quad (2).$$

The quantities on the RH side of equation (1) are known, therefore R can be determined.

By substituting for R, S and l in equation (2) the angle $\propto$ can be determined.

EXAMPLE XI.—(3) To determine the length of a reverse curve of given radius between two parallel lines:

$$\text{Cos} \propto = \frac{2R - S}{2R}$$

$$L = 2R \sin \propto.$$

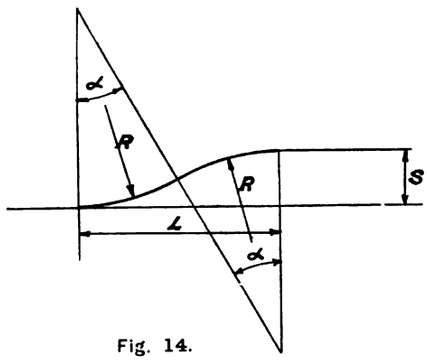

Fig. 14.

EXAMPLE XII.—(4) To determine the radius of a reverse curve between two parallel lines, length being fixed (Fig. 15):

$$(2R)^2 - L^2 = (2R - S)^2$$

$$4R^2 - L^2 = 4R^2 - 4RS + S^2$$

$$4RS = L^2 + S^2$$

$$R = \frac{L^2 + S^2}{4S}$$

$$\text{Angle} \propto = \frac{-1}{\sin}\left(\frac{L}{2R}\right)$$

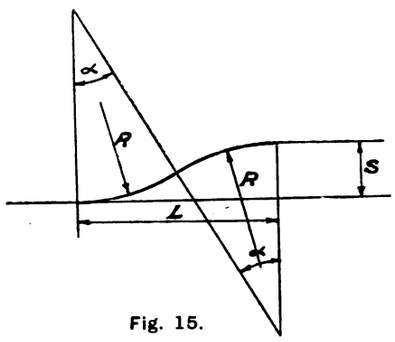

Fig. 15.

To determine a reverse curve between two intersecting lines PA, PB, the tangent point C being fixed at one end (Fig. 16):

Let PA, PB be the intersecting lines.

Let Angle BPA $= \propto$.

Let C = Tangent point to Radius R^1.

CO = Radius R^1.

Then $PO = \sqrt{CO^2 + PC^2}$.

$$\text{Tan}\ \beta = \frac{CO}{PC}$$

$$\gamma = \propto - \beta$$

$OS = PO \sin \gamma$.

$MN = R_2$.

$MT = R_2 + OS = R_2 + PO \sin \gamma$.

$$\text{Cos}\ \theta = \frac{MT.}{R_1 + R_2} \quad (1)$$

$SN = (R_1 + R_2) \sin \theta$.

$PS = PO \cos \gamma$.

Tangent length $PN = (R_1 + R_2) \sin \theta + PO \cos \gamma$ (2).

Angle $COM = (180 - \propto + \theta)$. (3).

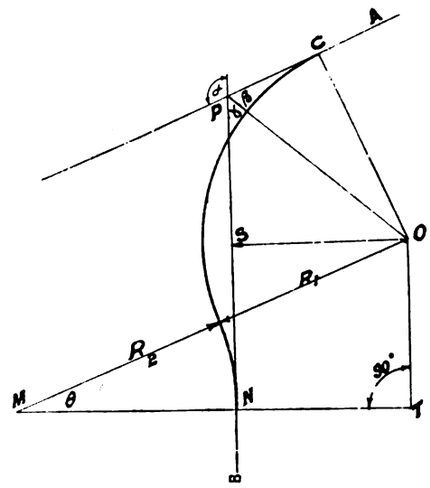

Fig. 16.

From the results of equations (1), (2), and (3) all the data required to set out the curves can be obtained.

STORAGE BATTERY CARS IN NEW YORK.

The accompanying illustrations give external and internal views of one of the single-truck type of storage battery cars which were built by the J. G. Brill Company, and have been running for over two years on the cross-town lines of the Third Avenue Railway Company, New York. The total number of these cars now in operation is 85, and the results are reported to be entirely satisfactory both to the travelling public and to the company. It is hardly necessary to point out that this is the most extensive example of storage battery car operation in the United States.

The makers of the cars give a list of situations which may present conditions favourable to the use of storage battery cars, and this is so interesting that we quote it in full. It will be observed that the various conditions are such as apart from accumulator traction would probably be met by the trackless trolley system, petrol omnibuses, or petrol rail cars. The following is the list:

1. Short rural lines not connected with other systems, yet meeting a distinct transportation need.
2. Extensions or spurs to existing electric systems, serving districts which it is desirable to develop, but where the immediate traffic will not justify overhead construction investment.
3. Lines operated to meet some local and special transportation demand other than general public service, as, for example, between mills or factories and a main railroad depot or residential centre, plantation railroads, belt line service in large manufacturing plants, and the like.
4. For the operation of branch lines or extensions used only during certain seasons of the year, as in connection with seaside and summer resorts, amusement parks, and the like.
5. As an adjunct to steam lines to supplement the regular steam train service, furnishing local service at short intervals, and to branch lines, particularly on roads devoted largely to freight traffic where there is need of a passenger service, but insufficient traffic to justify regular steam train operation.
6. Where local ordinances or other reasons do not permit the use of overhead trolley construction.
7. For providing infrequent night or "owl" service.

Referring now to the New York cars, the truck is of the Brill running-gear type, specially designed for storage battery operation. It has an easy riding spring arrangement, and the wearing friction is reduced by the journal boxes being equipped with roller bearings. The motors are of the General Electric automobile

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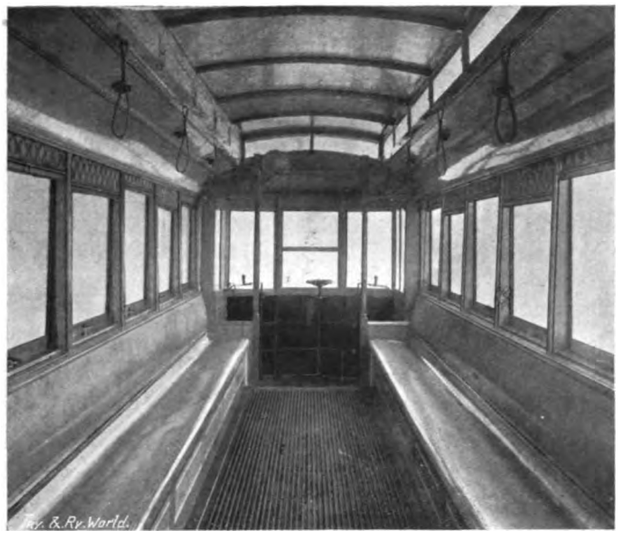
type, of 30 amperes at 110 volts capacity. The method of motor suspension and the arrangement of the single-reduction spur-gear drive and housing are in accordance with regular street railway practice. The control is by means of two General Electric type K45 controllers, one at each end of the car, and arranged for series-parallel motor operation.



Interior of Storage Battery Car in New York.

The battery consists of 58 cells of type MV29 "Bycap-Exide," manufactured by the Electric Storage Battery Company. The battery has a capacity of 67 amperes for six hours' continuous discharge at an average of 114 volts. It is placed beneath the longitudinal car seats in a ventilated compartment, where it is readily and completely accessible for inspection. There is no possibility of the fluid in the cells slopping over, and no fumes or odours can be detected by the passengers. The cells need no cleaning, and the battery need never be removed from the car or taken out of service in the ordinary course of operation. Ordinary cistern water is suitable for refilling to replace evaporation losses. The maximum direct-current voltage fully to charge the battery is 150 volts. The normal charging rate is 70 amperes. The dimensions of the car are:

Length of body	18 ft. 0 in.	Height from rail to top of roof	10 ft. 8 in.
Length over platforms	25 ft. 6½ in.	Centres of side posts	2 ft. 6½ in.
Length of platforms	3 ft. 9½ in.	Seating capacity	26
Length over bumpers	26 ft. 1½ in.	Wheel base	7 ft. 6 in.
Width over posts	7 ft. 6 in.	Diameter of wheels	30 in.
Height from rail to top of floor	2 ft. 9¼ in.		

The total weight of car, truck, and battery is approximately, 14,000 lb.

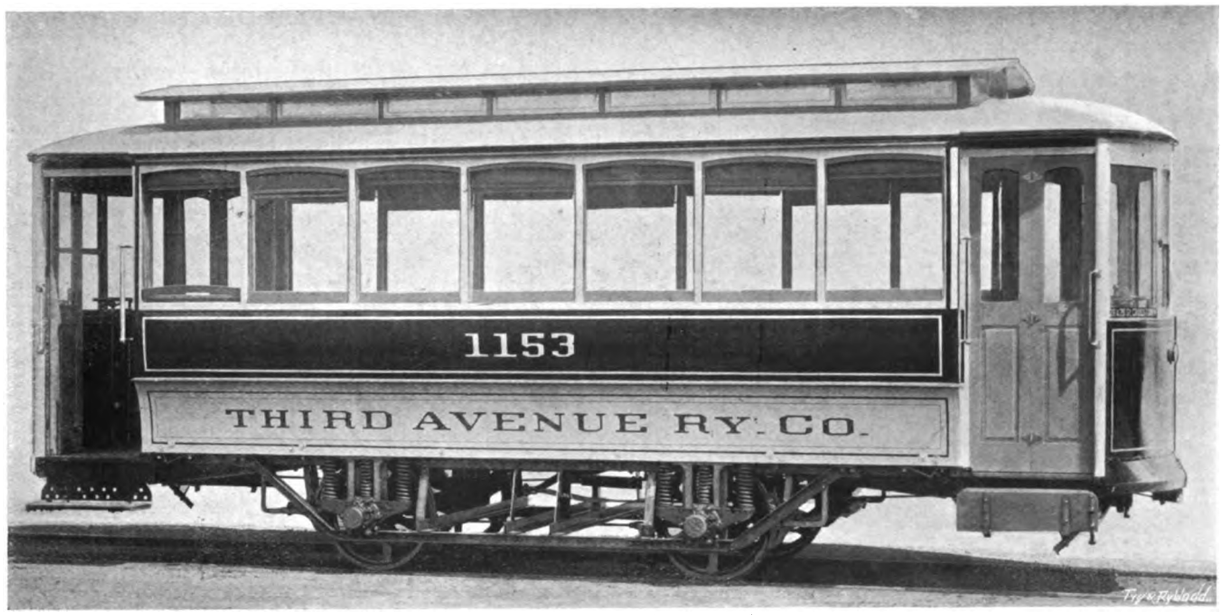
This car has a maximum speed of 15 miles per hour on level track, and will readily take a 7 per cent. gradient with full passenger load. The radius of action is about 100 miles per charge, and records show that 120 miles on a single charge have been secured in actual service. This type of storage battery car does not require expensive skilled labour for successful operation and maintenance.

The same builders also produce a double-truck storage battery car which is on the same general lines and is mounted on Brill 69E trucks. The maximum speed on the level is 25 miles an hour. The battery consists of 88 cells of the same type as that used in the single-truck car, and has a capacity of 67 amperes for six hours' continuous discharge at an average of 173 volts. The dimensions are as follow:

Length of body	30 ft. 0 in.	Height from rail to top of roof	11 ft. 7½ in.
Length over platforms	39 ft. 0 in.	Width over posts	8 ft. 2 in.
Length of platforms	4 ft. 6 in.	Truck wheel base	4 ft. 6 in.
Height from rail to top of floor	3 ft. 7⅛ in	Diameter of wheels	30 in.

CAR SEATING.

As manufacturers of seats and seating materials which are both durable and artistic, the General Seating Company, Limited, 13, City Road, London, E.C., find it profitable to use the best skill that engravers and printers can provide for giving suitable publicity to the company's productions. Their latest handsomely-produced portfolio gives representations in colour of the interior of a dining coach, showing seats upholstered in rattan; an "opera" back-to-back dining car seat upholstered in leather; and four types of the patent "Carlyte" reversible-back seats, two upholstered in rattan, one in plush, and one in rattan with leather head rest. A specimen illustration from the portfolio has been included by the General Seating Company in their advertisement in our present issue.



Storage Battery Car—New York.

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THE
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The Limit of Size for Tramcars.

Generally speaking the size and seating capacity of a car should vary with the density of the traffic in which it is to be employed. That is to say, where the cars follow one another closely over the track they may advantageously be made larger than where they are more widely spaced. Thus small towns are appropriately equipped with small cars, and large towns with large; and since the tendency is for all towns to grow and for the density of traffic in each of them to increase with still greater rapidity, it becomes worth while to consider whether the cars should be allowed to grow also to the same indefinite extent, or whether there is not a limit to the size to which they may usefully be permitted to develop. It is probable the limit is at least within sight, if not already reached, in some of our big cities. In considering a question where great density of traffic is the determining factor, one's mind naturally turns to the metropolis with its large and closely-packed population. Here, if anywhere, cars of the largest size might be employed with the greatest advantage, and those responsible for the adjustment of the working factors of other growing towns in the kingdom will naturally turn to the experience of the metropolis with the large and heavy cars there in use to learn how far they may wisely proceed in replacing obsolete cars with cars of greater size as the density of their traffic improves. The remarks of the manager of the London County Council Tramways in our issue of July 11 last on the consumption of current on that system deserve special attention in connection with this problem. "The density of vehicular traffic in London is directly responsible for a considerable proportion of the energy consumption, and it may be mentioned that observations taken over a considerable period on specially metered sections of the route have shown that the consumption is consistently in the neighbourhood of 1·2 to 1·3 units per car-mile on Sundays, when the streets are comparatively clear. This corresponds to a fall of some 35 per cent." That is to say the week-day consumption of current per car-mile is more than half as much again as the Sunday consumption per car-mile. This indicates very clearly that as the density of traffic increases, a point must eventually be reached when further additions to weight and capacity of the car introduce greater difficulties than they remove. Not only is there a greater tax on the permanent way, but additional weight involves more loss of energy at each stopping; additional seating capacity, if occupied, implies greater frequency of stops, and the high density of traffic, the original justification for the enlargement of the cars, brings with it the likelihood of congestion of road traffic generally, thereby entailing numerous checks to the speed of cars whereby, again, energy is unprofitably dissipated. Moreover the body of the car when it much exceeds the size of an ordinary vehicle obstructs the view of those in charge of the latter and so tends to aggravate the evils of congested traffic, thus exacerbating the difficulties already enumerated. There is little doubt that much of the opposition made by the police to the use of trailer cars in the metropolis has arisen from the great size of these double-decked conveyances and the obstruction they offer to a clear view of the street. It does not follow that the objections of the police are well founded, but it is a factor to be taken into consideration when fixing the limit to which the size of cars may be advantageously advanced in those localities where the density of traffic is continuously increasing.

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Traction in 1912.

The year 1912 was not marked by any great activity in the construction of new tramways or light railways in this country. Apart from a few extensions, both municipalities and companies have contented themselves with fostering their existing undertakings, and the results of effort in that direction have on the whole been encouraging. Traffic receipts have been good, and in a large proportion of cases the financial position of the undertakings has been substantially improved. This can be affirmed in a general way, though, of course, actual results can only be known when the reports are issued during the next few months. One of the most noteworthy experiments of the year was the doubling of the length of the halfpenny stages in Glasgow. The first 12 months of that experiment came to an end a few weeks ago, and a return which has been issued shows that the number of passengers has increased so enormously that the receipts do not fall much short of those of the previous year. To what extent the expenditure has gone up will be shown when the annual report is available. In the latter part of the year the system of return tickets was adopted on all the main routes of the London County Council tramways, and the maximum fare of a penny has been adopted in a few additional towns where the length of the routes is not too great. The pay-as-you-enter system of cars has been adopted in Aberdeen, Gateshead, and Leicester, and there are indications that it will extend, as its advantages are so obvious, and as specific difficulties as to graded fares are overcome. Some highly original cars are being tried in Liverpool, and enormous "toast-rack" vehicles proved very successful in Blackpool in summer, when the conditions are very special. In the field of power generation, the supercession of the reciprocating engine by the turbine in large units goes on gradually. For small units the Diesel oil engine obtains increasing favour. In the domain of electric railways, we have the prospective great developments in the London district, and the important experiment with high-tension direct current about to be inaugurated at Bury. The trackless trolley system has, in a few towns where it is at present running, established itself as a most valuable and economical method of traction on routes of small traffic and as a feeder to tramways. It is being installed in a number of additional places, and powers are being sought by other towns for its adoption. The steam, petrol, and petrol-electric types of motor omnibus have been vastly improved, alike as regards reliability, economy, and silence. So far has this been the case that omnibuses are now engaging in fierce competition with tramways all over the metropolitan area. Neither method of transportation will make much profit where the competition exists, and the call is for co-ordination. The present phase will probably pass, as restrictions are likely to be imposed on omnibus traffic as the result of the present Parliamentary inquiry regarding the frequency of fatal accidents caused by the vehicles. In the country generally, apart from London, competition with tramways is not likely to arise, as the Municipal Corporations have power to prevent it. London also has seen during the year the fusion of the interests of the great bulk of the underground electric railways and of the omnibuses, and another amalgamation combining the Metropolitan Electric and the London United Tramways. The year has also been marked by the passing of the Light Railways Act, which amends and continues the Act of 1896, and in various respects is calculated to facilitate the promotion of light railways—an object much to be desired. The effort to bring the trackless trolley system within the scope of light railway procedure was baulked by the hostility of rural local authorities who insisted that the promoters of trackless trolley schemes should pay for road maintenance. As petrol 'buses do not pay for that, the unfairness of the proposal was so plain that the whole clause on the subject was omitted from the bill. In the year now before us some tramway extension schemes of considerable importance will be brought before Parliament, and as already indicated the trackless trolley will seek largely to extend its boundaries. The London omnibus question will have to be settled, and coupled cars are likely to begin running in the capital. There will be much important railway electrification work in and around the metropolis and possibly in the north of England. The use of tramway renewal funds will be made more than ever manifest, as track renewal is becoming more and more frequent. With the trade of the

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country in such a flourishing condition, all that is required is good weather to make the tramway traffics of the most cheerful kind. Only the wretched climatic conditions of the past year prevented it from being a still more notable one as regards receipts. With respect to the electric manufacturing industry, 1912 has been a period of great activity; shops have been full and prices greatly improved. A large proportion of the work has been for tramways, especially for lines abroad, but the flow of home orders in respect of renewal work is now much greater than in the early years of electric traction, and probably it is yet some distance from its maximum. On the whole, the immediate past has not been discouraging, and the immediate future is hopeful.

The Glorious Uncertainty of the Law.

Without going as far as Mr. Bumble and calling the law "a ass," it cannot be denied that many legal decisions are difficult to reconcile with the ordinary rules of common sense. This is especially the case whenever technical points are involved—as in compensation cases in tramway accidents; in litigation with reference to transfers of tramway undertakings from one body to another; and, very often, in applications for running powers. The greater the forensic talent of the counsel on either side, the more scientific the evidence of experts, the more befogged are judges or coroners, and especially juries, when they have to puzzle out intricate cases involving details of management, construction, and maintenance. Many instances of this general groping in the dark might be cited, but two are enough; these, though not very recent, are so typical that they will serve as good illustrations. In a certain case where the power of a steam engine was in dispute, the judge and the counsel on both sides, not to mention the unfortunate witnesses under examination, all became inextricably mixed up owing to the extraordinary notion that a feed pipe was another name for a steam pipe. Witnesses were badgered as to why closing the feed pipe might endanger the safety of the boilers, and so on. It was not till someone realised the mistake that this particular tangle was straightened out, although others kept occurring during the trial. The other case was notorious at the time, where an assertive but inexperienced man like a certain senator put fatuous questions to, and harrowed the feelings of people who had just passed through some of the most awful experiences that any human beings had ever suffered. The remedy for all this is so simple that it is extraordinary it has never been applied. In enquiring into the causes of wrecks the judge is always assisted by two nautical assessors, who can keep him straight and render unnecessary the asking of silly questions or prevent wandering from the point at issue. In the first case mentioned above had two mechanical engineers assisted the judge much time and confusion would have been saved, and had two nautical men been appointed to sit on the "Titanic" Senatorial Committee in the United States, the proceedings, which would have been laughable under any less distressing circumstances, might have been kept within the bounds of decency and common sense, while much mental suffering would have been saved, and the enquiry would have been of greater assistance to the more judicial investigation that subsequently followed on this side. In the absence of any guides it would certainly be safer, in jury cases, to return open verdicts, as was done in another instance where, after many days' hearing, the jury declined to apportion the blame, between a turret that fell and a beam that gave way, by bringing in the verdict that the death of a workman who was killed was due to the wreck of the building—the cause of such wreck being undetermined. In arbitrations, as a rule, a mean of the two amounts in dispute generally meets the justice of the case and, we suspect, is oftener allotted by the arbitrator than litigants suppose. The assistance of two men as assessors of ample experience and practical knowledge in tramway matters would be welcomed by all those whose aim it is not to fish in troubled waters, but to get at the just solution of a dispute.

CAR, TROLLEY, AND MOTOR OMNIBUS BUILDING.

In their Parliamentary Bill for next session, Bradford Corporation apply for powers to manufacture tramway cars and trolley vehicles and to provide and fit up workshops. The department are now equipped with a large workshop in which repairs and some constructional work are done. Other municipalities possess powers to manufacture tramcars, but the application is a novelty so far as railless trolley cars are concerned.

Leeds Council have rejected a proposal made by the Labour members to delete from the application for powers to run motor omnibuses the line which states that the Council shall not manufacture the vehicles. The town clerk mentioned that in 1910 the Corporation were refused powers to make omnibuses, and Alderman Badlay replied that Parliamentary Committees were now composed of men of entirely different opinions from what they were on the occasion of the last application.

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WELFARE WORK OF THE GLASGOW CORPORATION TRAMWAYS.

The uniformed traffic staff of the Glasgow Corporation Tramways now numbers 2,907, and the cleaning and repairing staff at the depots numbers 681. The number of men employed in all branches of the service has now reached the imposing total of 5,394. The number on the staff is still increasing, chiefly on account of the extra cars which are gradually being put into service to cope with the enormous number of additional halfpenny passengers which is now being carried, through the introduction of the "long halfpenny-worth." It has been found impossible to carry an extra million passengers per week without putting more cars on the street.

Much attention has always been given to "welfare work" by the officials, members of the Tramway Committee, and the tramway employees themselves, and there is probably no other tramway system anywhere in which the work has assumed so great a variety or is supported more enthusiastically than at Glasgow. By the courtesy of the general manager, Mr. James Dalrymple, we are here enabled to give an account of the various organisations of the men, and the extent of their activity in social work.

As far back as 1896 a Friendly Society was instituted, and this has now over 4,000 members. The income of this society consists of sixpence per week from the members and threepence per week from the Tramways Committee. The benefits are:

15 shillings per week during sickness.
Medical attendance and medicine.
£20 on death.
£5 on death of a member's wife.
Admission to infirmaries, convalescent homes, etc.

Unfortunately, owing to the passing of the National Insurance Act, it has been found necessary to wind up the society, as it was not considered advisable to form an approved society under the Act. The society will, consequently, cease to exist as from January 15. Nearly one-half of the members of the society have, however, arranged to form an auxiliary society, to which the Tramways Committee have agreed to contribute one penny per week per member. It is proposed that the member's contribution to this auxiliary society should be threepence per week. In return for this contribution, it is estimated that the members will get five shillings per week during sickness. This added to the 10 shillings per week from their approved society will make 15 shillings per week, which is the amount of aliment paid from the present society. It will also be possible to continue the £20 on death and the £5 on death of a member's wife, also admission to convalescent homes, etc.

It should also be noted that the men have been accumulating a fund during the past 16 years for superannuation. This fund now amounts to about £40,000. In addition to the above funds, the men at the various depots have formed their own small sick funds, out of which small sums are given in extreme cases of hardship and long illness. Besides all these provisions for times of sickness, the men have voluntarily contributed to individual members of the staff during the past few years considerable sums. These sums have reached, in some years, to as high a figure as over £300.

At each depot the department provides the staff with a fully equipped gymnasium, and at the newer depots there is also a hall which can accommodate 400 people. At a number of the depots the members have a billiard table. Some depots find that they require two tables. These tables are the property of the men's Social and Recreation Club. The first year's revenue is generally devoted to defraying the cost of the table, and after this cost has been fully met the drawings are available for charitable and other purposes. At all the depots the game of draughts is largely played, and at several there are many chess enthusiasts. Carpet bowls seems also to be a very popular game, and at some of the depots the men have become expert players.

A very large number of the motormen and conductors are entitled to wear the badge of the St. Andrew's Ambulance Association. For some years a very keen interest was taken in ambulance work, and in competitions no ambulance team had much chance against a team of tramway men.

Glasgow is, of course, a noted football centre, and although the tramway men have few opportunities for attending Saturday afternoon football matches, they play a great deal. Each depot has its football team, and the whole department is formed into a football league. The games are all played throughout the week. No organised body of men in Glasgow is without its golf club, and the tramways department of the Corporation contains a large number of first-rate golfers. The event of the year is the match with the golf club of the Edinburgh Tramways Company. Although the east coast of Scotland is the home of golf, the Glasgow men are frequently the victors. As Glasgow is well provided by the Corporation with swimming baths, the Tramways Swimming Club is very strong, and the men frequently give a good account of themselves at open competitions.

On the occasion of the visit of Lord Kitchener to Glasgow last year to receive the Freedom of the City, the general manager had all the uniformed men in the department, who had served in the Navy or the Army, to the number of 434, paraded in the quadrangle of the City Chambers, where the gallant Field Marshal spoke to many of the men who were wearing medals, and afterwards addressed a few words to the whole company. A photograph of the men is reproduced on the next page and it shows what a great gain in the smart appearance of the employees is secured by an undertaking which employs well-disciplined ex-members of the Army and Navy. One of the companies of the 6th Batt. H.L.I. is entirely composed of tramway men. The company is 80 strong, and is the largest individual company in any Territorial corps in the city. A large number of the staff of the department are members of other corps, and attend the training camps every year. As many as 600 men are allowed off duty during the camping season, which occurs in the month of July. It fortunately happens that July is the quietest month in Glasgow, and, consequently, a very restricted service of cars can cope with the traffic.

The tug-of-war team connected with the 6th Batt. H.L.I., which is entirely composed of men belonging to the tramways department, were winners in 1910 of the Territorial Championship, Glasgow, and also in the same year of the National Territorial Championship, London.

The department have one of the finest pipe bands in the city. The band consists of 14 pipers and six drummers. The band is, of course, dressed in Highland costume, the tartan being specially designed for the use of the tramways department. The band frequently have engagements from the Corporation to play in the public parks during the summer months. The tramways orchestra consists of 30 performers. They have been supplied with a smart uniform and also with instruments by the Tramways Committee. During the winter months many social evenings are spent by the men and their friends in the halls and recreation rooms at each of the depots. At these meetings

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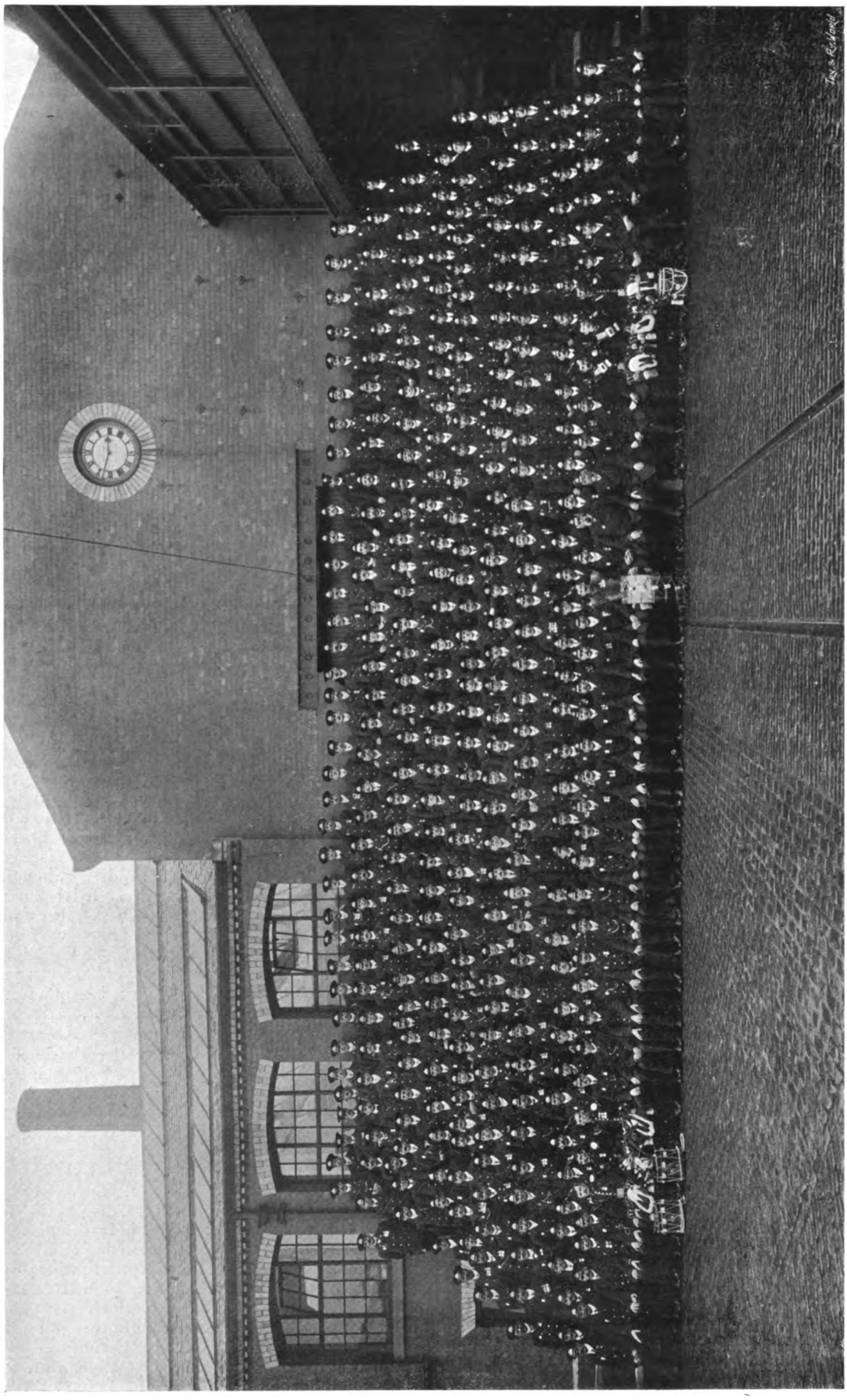

Ex-Navy and Army Men of Glasgow Tramways Uniformed Staff.

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members of the Corporation preside, and already this winter several very successful dances have been organised.

At the present time a very popular form of entertainment is wrestling and boxing, the halls and gymnasia being very suitable for this.

The Tramways Committee and the Corporation have always been willing and anxious to grant every facility to the employees in the tramways department for carrying on "welfare" work.

The Tramways Committee have presented as trophies for competition an ambulance shield, cups for shooting, swimming, draughts, and football; and they also frequently present badges to the swimming teams.

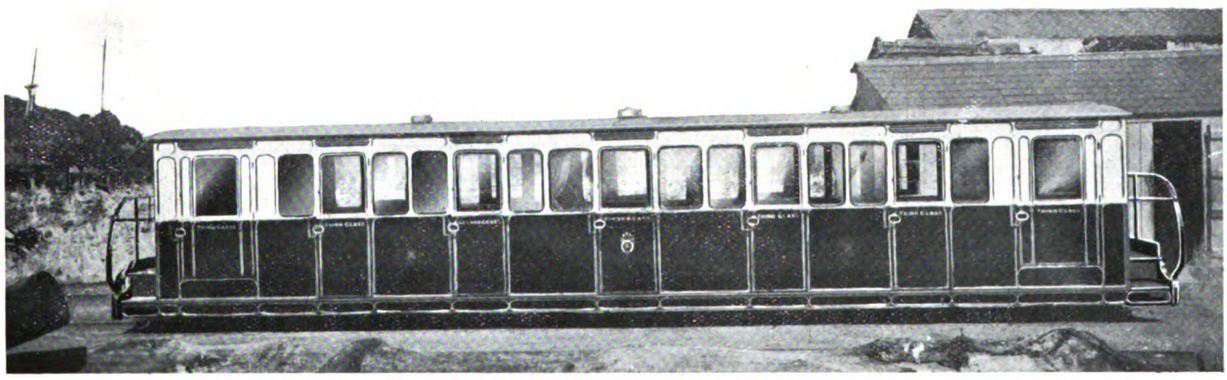
A STEPLESS CAR OF FORTY YEARS AGO.

In connection with the experiments now being made in the United States with stepless cars—that is, a car with floor so low that the passenger steps right on to it from the street—to which reference has already been made in these pages, it is interesting to note that the idea was in practice in this country nearly 40 years ago. The accompanying illustration shows an eight-wheeled bogie coach which Mr. George P. Spooner, M.I.Mech.E., designed for the Festiniog Railway in 1872. With the exception of the two compartments with entrance from the end platforms the coach is stepless, although the rise of 15 in. from the rail level to the floor is greater than desirable for tramway use. Early in 1873 coaches of this design were put in service. The following were the principal dimensions:

	FT.	IN.		FT.	IN.
Gauge of Railway	1	11½	Width, over all	6	0
Centres of bogies	27	7	Height, floor to roof between bogies	6	1
Length over body	32	9	Height, floor to roof over bogies	5	1
,, ,, platforms ...	35	9	Height, floor to rail ...	1	3
,, ,, buffers ...	37	8			
Wheel base of bogies ...	3	6			
Diameter of wheels ...	1	7½			

The car seated 50 passengers, including six first-class, eight second-class, and 36 third-class.

The determination at that early date to put bogie stock in service was in a great measure due to interchange of ideas with several American engineers during their visits to the then unique and famed little railway, and it is believed that these were the first bogie coaches to be used on a railway in Europe. For the details given above we are indebted to Mr. Spooner.



Stepless Car Designed for the Festiniog Railway in 1872.

Demand for Double-Decked Cars in Bombay.—The Corporation have received a letter from Bombay residents suggesting that the proposed increased fares should not be sanctioned until the company run double-decked cars to meet the morning and evening congestion.

THE WARNER TRUCK IN CEYLON.

The car depicted in this illustration has been built to the order of the Warner International and Overseas Engineering Company, Limited, Carteret Street, S.W.,

Colombo Car on Warner Truck.

for the Colombo Electric Tramways in Ceylon. The axles are on the well-known Warner non-parallel system, the wheel base in this case being 10 ft. This is the third order from Ceylon received by the company.

ST. PETERSBURG TRAMWAY PROBLEMS.

Mr. N. J. Timopheieff, traction manager of the St. Petersburg Tramways, in a recent report on the St. Petersburg system, says that the first Russian tramway was established in Kieff in 1896. After tracing the development of tramways in Russia generally, he found, referring particularly to St. Petersburg, that the tramway system there suffered from two principal defects—want of workshops and deficient power at the central station. He could suggest no way with the present equipment to reduce the enormous overcrowding in St. Petersburg cars. A London car, he said, carries 1,140 persons a day: the St. Petersburg cars carry 4,000 each. It has been demonstrated in European-Western countries that a town with a population of 2,000,000 cannot be served with a system of tramways only, and St. Petersburg, like other towns, should have recourse to a metropolitan or overhead electric railway. All other measures are purely palliatives. He found the St. Petersburg tramways sadly short of reserve cars. Whilst the American systems have a reserve of 15 per cent., the Russian reserve is only 12 per cent. motor cars and 1 per cent. trailers. Sometimes practically all the rolling stock is in service. At present it is almost useless to think of increasing the number of cars. There is no accommodation for them. But the technical equipment of the St. Petersburg tramway system he found with trivial exceptions to be quite satisfactory. The average speed is 12 to 15 kilometers per hour. Motor cars cost 1,200 roubles (£127) for repairs a year; trailers, 300 roubles (£32). The average life of a car without repairs is about 13 months. Though the number of accidents increases positively, they are relatively declining.

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IMPORTANT TRAMWAY JUDGMENTS DURING 1912.

By a Barrister-at-Law.

Although the past year was not fertile in judicial decisions on tramway law, two judgments at least have been of first-class importance. In March last there was the case of the *Salford Corporation and South Lancashire Tramways Company v. Eccles Corporation*, which was brought on appeal to the House of Lords; and the *Metropolitan Electric Tramways, Limited v. The Tottenham Urban District Council*, which was decided a little earlier by the Court of Appeal in February last. It is understood that the latter case will be the subject of appeal by the District Council to the House of Lords. Both cases are worthy of careful attention.

SALFORD CORPORATION AND OTHERS (APPELLANTS) v. ECCLES CORPORATION (RESPONDENTS).

Licence without consent of Board of Trade—Agreement ultra vires.

The facts of this case were as follow: Eccles Corporation brought an action claiming a declaration that the Salford Corporation and the South Lancashire Tramways Company were not entitled to authorise the tramways company to use the tramways of the plaintiffs, and also claiming an injunction against the defendant tramways company to prevent them from running cars over and along the said tramways, and from otherwise using or trespassing upon the said tramways. Salford Corporation owned and worked tramways in the borough of Salford under the Salford Corporation Act. The tramway company owned and worked tramways in the Worsley urban district and elsewhere under the South Lancashire Tramways Acts, 1900 and 1903. Salford Corporation Tramways extended to the eastern boundary of the borough of Eccles, the tramway company's tramways to the western boundary.

The Eccles Corporation Act of 1901 incorporated parts II. and III. of the Tramways Act, 1870, so far as applicable to the purposes of, and so far as they were not varied or inconsistent with the Act of 1901. Eccles Corporation had power to lay down tramways within their area, including the tramway which was the subject of the action, and were liable to repair the rails of the tramways and the substructure, and subject to penalties for defaults.

Section 24 of the Act empowered the Corporation to enter into and carry into effect contracts with owners and lessees of tramways in adjacent districts which could be worked with any of the Corporation tramways and the local authority of such district, *inter alia*, with respect to the working, use, and management by the contracting parties of all or any of their respective tramways and works or any part or parts thereof. It provided that the term of any lease or working agreement should not exceed 42 years, and that the conditions should be subject to the approval of the Board of Trade. The Salford Corporation Act, 1899, incorporated parts II. and III. of the Tramways Act, 1870, in similar language to that employed in the Eccles Corporation Act. By the definition clause, "In this Act unless the subject or context otherwise requires," the Corporation tramways included the tramways and any tramways for the time being belonging or demised to or worked by the Corporation.

Section 28 of Salford Corporation Act conferred a similar power to that conferred by Eccles Corporation Act in section 24 with respect to entering into and carrying into effect contracts with respect to the working and managment of tramways with the owners and lessees of tramways in adjacent districts, but with two important exceptions. The Act contained no restriction as to the duration of any lease or working agreement, and did not require the approval of the Board of Trade to a lease or working agreement.

The South Lancashire Tramways Act, 1900, also incorporated parts II. and III. of the Tramways Act of 1870. Section 83 conferred a similar power to those already mentioned to enter into working agreements with adjacent owners, but the consent of the Board of Trade was not required. A special Act of 1903 conferred a similar power.

In 1902 Eccles and Salford Corporations entered into an agreement empowering Salford Corporation to construct the tramways comprised in the Eccles Corporation Act at the expense of the Eccles Corporation. Salford Corporation constructed the tramways, including the tramway in dispute. By the terms of this agreement Eccles Corporation agreed to grant Salford Corporation a lease for 35 years from the second Monday following the date on which the tramways should be certified by the Board of Trade to be fit for public use. No lease was in fact granted.

The tramcars, with the drivers and conductors, were to be supplied by Salford Corporation and licensed by Eccles Corporation; Eccles Corporation were to maintain the tramways to the reasonable satisfaction of Salford Corporation. The lease was to be made with the benefit of the rights and subject to the powers and obligations of the Eccles Corporation under any Act or Order relating to the tramways (except where inconsistent with the terms of the agreement and of the agreed lease), and to be subject to the approval of the Board of Trade if and so far as necessary.

A further clause provided that Salford Corporation should not assign or sublet or part with the benefit of the agreement or the agreed lease except by licence under the seal of Eccles Corporation, and upon any breach of this stipulation Eccles Corporation were at liberty forthwith to determine and cancel the agreement or agreed lease. Thereupon the interests of the Salford Corporation ceased without prejudice to any liability previously incurred by them to Eccles Corporation.

In January, 1908, Salford Corporation granted to the South Lancashire Tramway Company a licence to use a small portion of the line on the western boundary of the borough of Eccles, which had only been worked intermittently by Salford Corporation. The licence distinctly stated that it was a mere licence conferring no rights upon the tramway company; the Corporation could stop tramcars running, and the company could cease running when they desired.

Eccles Corporation, on objecting to this licence, were met by a claim on the part of Salford Corporation, to the right to authorise the tramways to run without the licence of Eccles Corporation.

On the case coming on for trial before Mr. Justice Eve, he dismissed the action on the ground that there had been no breach of agreement; and that the licence was not *ultra vires*.

The Court of Appeal decided that the licence was *ultra vires*, and reversed Mr. Justice Eve's decision on the ground that neither under the Tramways Act of 1870 nor under their special Act had the Eccles Corporation powers to authorise the Tramway Company to run cars over their tramways without the consent of the Board of Trade, and that the agreement made with Salford Corporation did not purport to give any greater right than that which Eccles Corporation could grant.

Salford Corporation appealed to the House of Lords. The House of Lords dismissed the appeal. Lord Loreburn (Lord Chancellor), in delivering judgment, stated that the grounds on which the case had been decided by the Court of Appeal had not really arisen in the argument, because another point had emerged which was sufficient to prove fatal to the case of the appellants. A licence had been given, but the Corporation of Eccles could not have granted this licence without the consent of the Board of Trade. The consent of the Board of Trade was not obtained. It is said that there is a demise for 35 years from the Eccles Corporation to the Salford Corporation, and that under the fourth section of the Salford Act, this tramway having been so demised became a Salford Corporation tramway, shifted from the operations of the Eccles Act, and subject to the limitations contained in the Salford Act. Therefore that this section 28 of the Salford Act enables Salford Corporation to give this licence without the consent of the Board of Trade. A suggested complete or partial emancipation from the Eccles Act under which the tramway was built to the Salford Act under which it was not built would be a strange result to spring from a definition clause. It is not necessary, however, to scrutinise too closely the language of the definition in the Salford Act, because the definition is expressed to be "unless the subject or context otherwise requires." The subject or context does otherwise require. The appeal was dismissed with costs.

THE METROPOLITAN ELECTRIC TRAMWAYS, LIMITED v. TOTTENHAM DISTRICT COUNCIL.

Tramway Assessment, Public Health Act, section 211, sub-section 1 (b)—Meaning of land used only as a railway.

This case came before the Court of Appeal on appeal from a Divisional Court upon a case stated by justices. The Tottenham Urban District Council summoned the Metropolitan Electric Tramways Company, Limited, in respect of a rate amounting to £495 12s. 6d. The company paid £123 18s. 2d., but refused to pay the balance of of £371 14s. 4d. The justices ordered payment, but stated a case for the opinion of the High Court, from which it appeared that the company were rated in respect of their tramway hereditaments at the rateable value of £4,575, and the sum of £495 12s. 6d. was the amount of rate in respect of the rateable value. The appellant company paid £123 8s. 2d., being the total sum charged by the said rate calculated on one-fourth part only of the rateable value. The appellant company were owners and occupiers of a tramway and light railway, which were constructed along certain public streets and roads, in the district of Tottenham Urban District Council. The lines were constructed and worked under and subject to the provisions of certain local Acts and Orders, and were worked by electricity on the overhead system, and had a junction with each other and also junctions with other tramways and railways outside the district.

The tramway and the light railway as to mode of construction and the materials used thereon were identical, and consisted of lines of iron or steel grooved or slotted rails, laid with the uppermost surface thereof level with the surface of the highway, and overhead wires suspended from posts placed alongside of or in the middle of the streets to convey the electric power required for moving the carriages thereon. The carriages used upon the tramway and the light railway were the same carriages, and had flanged wheels running on the rails, and the same carriages used on the tramway ran through and over the light railway for the conveyance of passengers and parcels thereon as part of one common system. The charges authorised by the Acts and Orders were the same.

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The tramways company contended that they were entitled under section 211, sub-section 1 (*b*) of the Public Health Act, 1875, to be assessed to the general district rate at one-fourth only of the railway's net value.

This section, as far as material, runs as follows:

"The occupier of any land covered with water, or used only as a canal or towing path for the same, or as a railway constructed under the powers of any Act of Parliament for public conveyance, shall be assessed in respect of the same in the proportion of one fourth part only of such net annual value thereof."

The Divisional Court considered themselves bound by the decision of a Divisional Court in the case of Swansea Improvements and Tramways Company *v.* Swansea Urban Sanitary Authority, 1892, 1 QB. p. 357, and followed it.

The Court of Appeal allowed the appeal, overruling the above-cited decision.

Shortly stated, the judgment of Lord Justice Farwell turned—

(1) On the meaning to be attached to the word tramway. He considered, adopting the language of Lord Shand (Glasgow Corporation *v.* Assessor of Railways and Canals, 48, Sc. LR, p. 5) that a tramway was a species of railway, and railway and tramway undertakings respectively take their names as such from the fact that they possess and use for purposes of conveyance rails fixed in the ground, but differing in construction.

(2) On the meaning of the exemption from rating as to three-fourths of the net annual value explained in South Wales Railway Company *v.* Swansea Local Board 4E and Br 189 by Mr. Justice Erle. The general scheme of the enactment is that the occupiers of the classes of property most benefited by the expenditure of the district rates shall be liable to be rated at a higher rate, the occupiers of the classes less benefited at the lower rate, and the class of property most benefited is that which is occupied immediately for the purpose of residence, and the kinds of property not so occupied are not to be rated so highly.

(3) On the decisions of the House of Lords in Blackpool and Fleetwood Tramroad Company *v.* Thornton Urban District Council (1907), 1 K B 568 (1909) A.C. 264.

"Once," said Lord Justice Farwell, "you have arrived at the fact that the way in question is used exactly as if it were a railway, and that there is nothing in any of the Acts to show that it is not to be regarded as that which it in fact is, it necessarily results that we must follow the later authorities." Lord Justice Kennedy was unable to see how the tramway differed from the railway with which it was interlaced in working, and where carriages could and did run on both the tramway and railway.

Warrington (J.) considered that the user only must be considered. "We have therefore to consider only the user of this way by the appellants. We must not consider whether it is a railway or tramway or anything else, but whether it is used as a railway."

IN *RE* THE WEST YORKSHIRE TRAMWAYS BILL, 1906.

Parliamentary Deposit—Abandonment of Tramway Undertaking—Landowner's Claim.

In the case of the West Yorkshire Tramways Bill of 1906, the Court was called upon to decide whether a landowner was entitled to compensation out of the Parliamentary deposit where a tramway company which had been authorised under a Tramways Act to carry out certain works, including the widening of a street—the widening of which comprised the taking of the landlord's property—had abandoned their undertaking.

In March, 1912, the promoters of the tramway company took out a summons for the repayment out to them of the statutory deposit which had been paid into court under the Parliamentary Deposit Act of 1846. The Master in Chambers certified that no property of any landowner or other person had been interfered with or rendered less valuable by the abandonment of the tramways. An application to court was made by the landowner, Mr. R. C. Foster, that he might be at liberty to come in and prove his claim for compensation as a landowner who had suffered loss by reason of the abandonment of the enterprise.

The facts were shortly stated as follow: Under section 5 of the West Yorkshire Tramways Act the company *inter alia* were empowered to effect a widening, No. 4—a widening in the parish and urban district of Elland, at Southgate and Victoria Roads. For the purpose of this widening the applicant agreed on March 3, 1906, to sell the promoters a portion of the site of a shop at the corner of Victoria Road and Southgate Road, Elland. The piece agreed to be sold was of a triangular shape, and the sale when effected left him another triangular piece between the land he was selling and the adjoining shop, facing Southgate Road. The land was purchased for the purpose of the widening. Section 81 of the Tramways Act provided that for the protection of the Elland Council concurrently with the construction of so much of Tramway No. 8 as is situate between West Vale and Elland Town Hall, and before opening such portion of the said tramway for public traffic, the company should execute and carry out to the reasonable satisfaction of the Council, the widenings, No. 4, authorised by the Act.

The effect of this section, said Mr. Justice Warrington, was that the company was under no absolute obligation to effect the widening. This was left to the discretion of the Elland Urban Council. If the company did not construct a certain portion of the tramway, then there was no obligation upon them to make the widening. If they did construct that part of the tramway then the widening was to be made unless the Urban Council agreed in writing with the company that it should not be made. The applicant was only entitled to come in as a creditor if there was some obligation on the part of the company to widen the street, and that obligation was broken, and therefore the applicant had no claim as a creditor since there was no contractual obligation between him and the company. Was he a person whose property had been interfered with or otherwise rendered less valuable by the abandonment of the tramway? In *re* Potteries, Shrewsbury, and North Wales Railway Company (25 Ch., D. 251) it was decided that it was the duty of the court to ascertain what was the value of the property before and after abandonment, and if any reduction in value necessarily resulted from the abandonment the landowner was entitled to compensation.

It was argued that immediately prior to the abandonment the position was this: If the tramway had been constructed and the widening made, then the applicant's triangular piece of land would have had a frontage to the street. Since it was not constructed it had no frontage, and its value was diminished, but the diminution was occasioned by the fact that the street was not widened. This did not necessarily arise from the adandonment of the tramway, therefore on the authority of In *re* Southport and Lytham Tramroad Act, 1900, *ex parte* Hesketh (1911), 1 Ch. 120, the applicant was not entitled to succeed. The applicant was not injured by the abandonment of the tramway, although he might have been, through the street not being widened.

(Chancery Division (Warrington, J.), Oct, 31, 1912.)

Subsequently the Master of the Rolls and Lord Justice Farwell heard an appeal from the decision. The court allowed the appeal, the Master of the Rolls saying it seemed impossible to say that Mr. Foster was not a landlord injured by the abandonment. The matter was therefore referred back to the Master in Chambers to inquire as to the amount to which the property had been interfered with or rendered less valuable by the abandonment.

AIMS OF THE YORKSHIRE TRAMWAYS COMPANY.

A noteworthy statement was made by Mr. H. England, general manager and secretary to the Yorkshire (West Riding) Electric Tramways Company, on December 17, at the first of the two annual dinners to the employees at Lofthouse Park, Wakefield. After apologising for the absence of Sir Herbert Leon, the chairman, and saying he had asked him to convey the directors' appreciation of the loyalty of the staff, Mr. England said: "The industrial unrest which has been so prevalent during the year has left our friendly relationship unimpaired, and the reason for this is that our men recognise that the directors consider the welfare of the employees even before the demands of the shareholders. We are operating in what is comparatively a sparsely populated district, and for many years it has been a hard struggle to bring the company into a reasonably satisfactory condition. The task of the directors has been a trying one, because they have had to meet the shareholders year after year and explain that it was quite impossible for a dividend to be paid on the share capital. We made up our minds to give the best service possible with the intention of educating the public to use the cars. For eight and a half years we have maintained a minimum 10 minutes' service between Leeds and Sandal, between Agbrigg and Ossett, a 20 minutes' service between Leeds and Rothwell, and a 15 minutes' service between Pontefract, Castleford, and Normanton. For the first few years the receipts from passengers per car-mile were low, but we stuck to our programme, and I think there is every prospect of those who put their money into the company receiving some return. The thinking men in our service realise that we have had a hard task, and they also know that the directors have done everything possible to make the conditions of service pleasant and agreeable, and have tried to remunerate the men in a fair manner. The men have responded loyally, and it is the cheerful recognition of the board's goodwill that has enabled us to carry on business with a minimum of friction and disagreement. I hope we shall never see our men refuse to submit their grievances to the management with the knowledge that if it is possible to provide redress that assistance and help will be afforded." (Applause.)

Cars for Women Only.—Councillor Whitehead asked the convener of Glasgow Tramways Committee, on December 26, if the committee would consider the advisability of introducing a car service for women only on Saturday afternoons when the ordinary car service is fully taxed by football crowds. Bailie Kirkland replied that he had no objection to bringing the matter before the Tramways Committee, but he could not hold out much hope of the suggestion being adopted. We may add that the London County Council last session obtained powers to reserve cars for women, and have since run one such car during the workmen's early morning traffic between Tooting and the Embankment.

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SOME PROBLEMS IN TRACTION DEVELOPMENT—TRAMWAY FEEDING NETWORKS.*

By J. G. Cunliffe, M.Sc.Tech., and R. G. Cunliffe, M.Sc.Tech.

The object of the paper is to present a suggestive treatment of the modifications which, as a result of continued development, are becoming necessary in the design of the feeding networks of large street railway undertakings and in the legislative limitations imposed thereon.

Street traction history has shown that, with increasing traffic density and greater distances traversed, consequent upon rapid growth of the cities, the methods of application of the requisite energy have been subject to continual change, and that, even after electrification, the equipments have undergone frequent transformation, generally piecemeal, but in some cases, as at Chicago, resulting in the complete rehabilitation of the whole undertaking.

Larger and more powerful cars are continually being adopted, and are run at closer intervals. Traffic stops increase in frequency, necessitating a quicker acceleration in order to maintain the schedule speed, and the rate of consumption of energy per car is greatly increased. The net result of this increased rate of consumption and of the reduced headway is to cause a still greater increase in the intensity of electrical loading as expressed in kilowatts per mile. These effects are illustrated by the comparative operating statistics given in

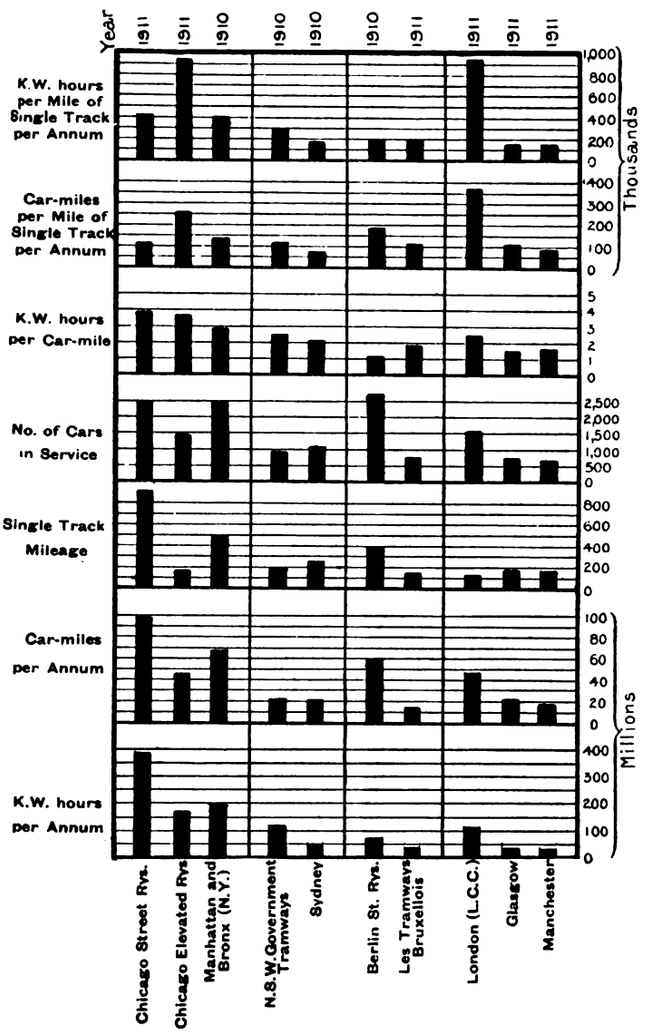

Fig. 1.—Comparative Operating Statistics.

Fig. 1 as between various undertakings, and by the curves on Fig. 2 for a particular undertaking. The values of the ratios illustrated by Fig. 1 are average ones only, the maximum values being much greater, and bearing, in general, no relationship to them. Thus at Manchester, owing to the small extent of the "City area," the rate of electrical loading at the centre is some 1,500 kw. per mile of route, and the rate of energy consumption of a car is some 38 per cent. greater at the city end than at the suburban end of a route. The intensity of electrical loading at London is very high, but is only of passing interest here, as the general case alone, with overhead principle of operation and uninsulated return circuit, is considered. Special references are made to Chicago owing to its very heavy loading, and to the fact that by the courtesy of Mr. Bion J. Arnold and the Board of Supervising Engineers the authors have been placed in possession of detailed accounts of the whole of the rehabilitation work.

If the number of supply stations were increased in proportion to the increase in the intensity of electrical loading, the nature of the feeding

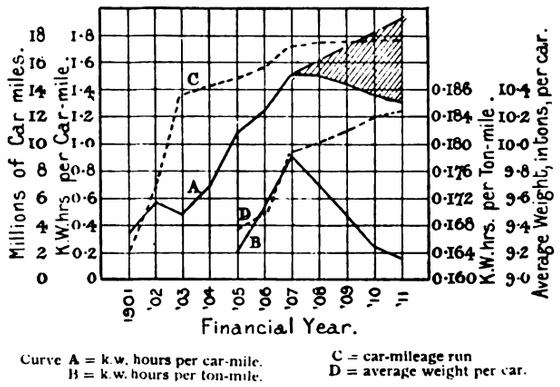

Fig. 2.—Operating Statistics for Manchester.

problems would remain practically unchanged, but this is not the case, the capacity of the stations increasing rapidly. Thus at Chicago several of the sub-stations are designed for an ultimate capacity of 18,000 kw., whilst sub-stations of 12,000 kw. capacity are not uncommon. These large stations are interconnected by heavy cables, which generally serve also as feeders.

It is obvious that, under these circumstances, in view of the strict limitation of the line pressure, the governing factor in the feeder designs must, at some stage of the development, change from overheating to pressure drop, and that boosting must ultimately be resorted to. Boosters have hitherto been adopted in isolated cases only, mainly in Great Britain, but electrical energy is very cheap in many foreign cities, and their use will undoubtedly become more common. As the intensity of loading increases, special means become necessary in order to maintain the rail drop at a sufficiently low value, and negative boosters must ultimately be adopted. The main principles underlying the use of boosters both positive and negative are therefore considered.

Positive Feeding.

With light loading and few supply stations the system of feeding illustrated in Fig. 3, A, is generally employed, and consists of feeders supported by distributors which may or may not be graded in size according to the nature of the load variation and to the special duties which they may be required to fulfil. With a large number of supply stations, as at Manchester and Liverpool, the simple feeder system shown in Fig. 3, B, is employed, since, even with the short lengths of feeding section available, with economical distribution through the trolley wires alone, the feed points are nearer to the stations than to each other. As the intensity of electrical loading increases, the length of feeding section rapidly diminishes, and with very heavy loading, owing to the reluctance of engineers to employ feeders much larger than 1 sq. in. in cross-section, the simple feeder system of feeding is universally adopted, although, in many cases, with modifications, as at Chicago, where the feeder is continued throughout the whole length of the section and tapped on to the trolley wires at intervals of from three to six spans, as shown in Fig. 3, C, the conductivity of the trolley wires being ignored in the design. The conductivity of the trolley wires is a matter of importance with the feeding system illustrated by Fig. 3, B, and at Manchester their section is increased, on renewal, according to the distance between feeders and to the intensity of loading, this being a temporary provision until such time as installation of additional feeders is justified by the increased intensity of loading, the rate of consumption of energy being reduced by this and similar means, as shown by the shaded area in Fig. 2.

Several feeders are often operated in parallel for the purpose of preventing too frequent opening of the circuit breakers controlling very heavily loaded sections; and, even with very short sections, it is observed that, owing to the relatively high conductivity of the feeders as compared with that of the trolley wires, the feeders do not share the load equally, the centre of gravity of the load moving over a range of quite half the length of the section. As the whole of the copper must be fully utilised, this has led to the use of heavy feeders with several short sub-feeders radiating to the adjacent feed points. This method is becoming very common, more especially for the feeding of complicated networks. It is equivalent to the installation of equalising cables between the feeders.

* Paper read before the Institution of Electrical Engineers.

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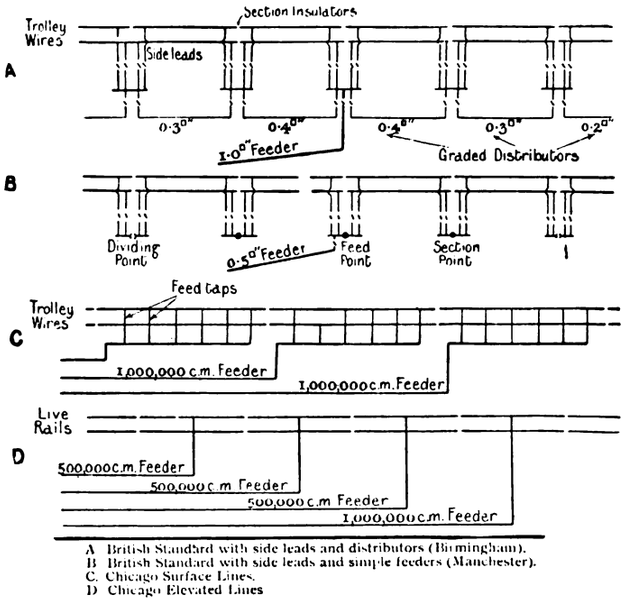
At Chicago the length of the feeding sections situated in the immediate neighbourhood of the station is such as to load the standard 500,000-cm. (0·3927 sq. in.) feeders to the limit of their safe-carrying capacity, but the more distant sections are of such a length as to give a limiting pressure drop of 50 volts on the same standard feeder, which, however, is doubled in size if the loading is very heavy and the distance great, the current density being greatly reduced. The methods of



A British Standard with side leads and distributors (Birmingham).
B British Standard with side leads and simple feeders (Manchester).
C. Chicago Surface Lines.
D Chicago Elevated Lines

Fig. 3.—Methods of Positive Feeding.

design have been fully described in a paper* by Mr. R. H. Rice, assistant engineer to the Board of Supervising Engineers, and the importance of pressure drop is shown by the fact that the equipments have been designed for a working pressure of 600 volts, which is also common to other very heavily loaded undertakings.

Overcompounding.

Little relief can be afforded long feeders by overcompounding, as the permissible pressure rise at the busbar is limited by the pressure rise which may be allowed at the feed points of the shorter feeders, and this should not exceed 10 per cent. If a pressure drop materially in excess of 10 per cent. is, for economical design, required in the long feeders, therefore, it becomes necessary to employ separate positive boosters.

Positive Boosting.

It is unsafe to operate a group of separate feeders from a common booster owing to the risk of abnormal pressure rise at the feed point of a temporarily lightly loaded section, and although, by parallel operation of the feeders, this risk may be avoided, the practice leads to unequal distribution of the load amongst the feeders, the shorter ones being overloaded. For satisfactory operation, therefore, a separate booster ought to be installed in each long and heavily loaded feeder, and with the heavy loading under consideration this would often be practicable.

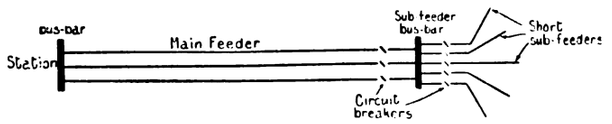


Fig. 4.—System of Feeding by Sub-Feeders, with Main Feeder only Compensated for Pressure Drop.

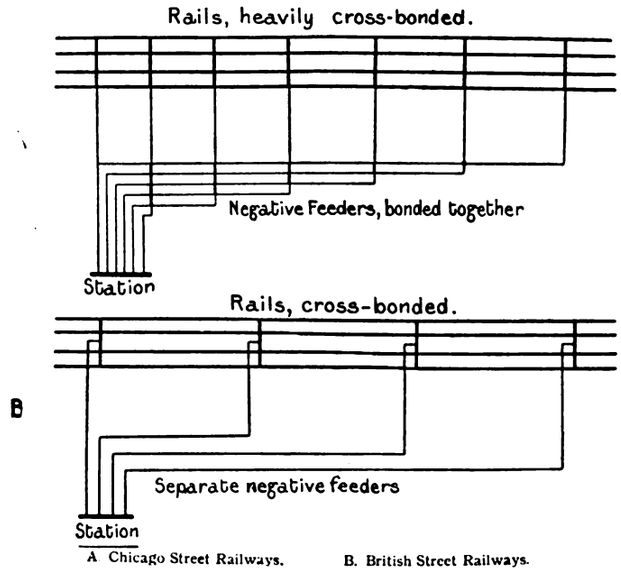
In order, however, to avoid the installation of a large number of boosters of varying capacity the authors would suggest that advantage be taken of the method already described of employing main feeders, each having several short sub-feeders. The arrangement is illustrated in Fig. 4, and the pressure drop in the main feeder alone would be compensated by the booster, so that the sub-feeder busbar would be maintained at a constant potential, the design of the sub-feeders being governed by considerations of overheating alone, and their load fluctuations not materially affecting the pressures at the feed points.

Automatic circuit breakers with tell-tale indicators at the generating station, whence they could, if desirable, be operated by remote-control, might be installed as shown in order to confine the area affected by a feeder breakdown, and would immediately localise the fault. A somewhat similar system to that shown in Fig. 4, but without booster, is employed on the lines of the New Jersey Public Service Railway Company, U.S.A., the circuit breakers in this case being mounted on cross-arms on a traction pole, and fitted with tell-tale indicators to the nearest office.

Engineers are so familiar with the principles of positive feeding that novelty is possible only in their application, and hence the light treatment, but this does not apply with the same force to negative feeding, concerning which there is still considerable difference of opinion.

Negative Feeding.

The general method of negative feeding is by means of separate feeders, as illustrated by Fig. 5, B. It is impossible to mechanically divide the rails into definite feeding sections as is done in the case of the "line," and all negative feeders from any station must be operated in parallel, the difficulties encountered arising from the resulting lack of exact control of the load distribution in the rails. The conditions are exactly the reverse of those applying to the parallel operation of positive feeders, the conductivity of the four rails of a double track being equal to that of some 4 sq. in. of copper, and hence greatly superior to that of any individual negative feeder. It follows, therefore, that with light loading the amounts of current returning by the respective feeders, if of the same size, will be almost inversely proportional to their lengths, and in order to compel the longer feeders



A Chicago Street Railways. B. British Street Railways.

Fig. 5.—Methods of Negative Feeding.

to do their duty they are in some cases made heavier than the shorter ones. In other cases resistance is inserted in the shorter feeders.

However carefully the negative feed points may be selected, the distribution of the return current amongst the feeders is, with very heavy loading, to a great extent governed by the nature of the load distribution, and there cannot be without excessive outlay in copper more than one point in the track on each side of the supply station at which there is no current flow, *i.e.*, the rails on each side of the station cannot be divided into more than two feeding sections in which the directions of current flow are mutually opposed, the direction near the station being outwards from it. It is merely a question of the balance of potential following Kirchhoff's laws. The balance point between the two sections can, for fixed loading conditions, be moved nearer to, or farther from, the station by increasing the resistance of the shorter negative feeders or by reducing that of the longer ones, and *vice versa*, but the extent to which, with heavy loading, this can be economically done is limited by the pressure loss in the feeders, since the latter alternative is too expensive in copper. For a given length of track with increasing loading the maximum permissible rail drop is ultimately attained when copper must be provided to carry any additional current, and as this copper is operated at a very low current density, its use is very uneconomical.

At Chicago, the 129 lb. rails are reinforced, as shown in Fig. 5, A, by bare copper cable increasing in section from 500,000 cm. (0·3927 sq. in.) on the outskirts of the sub-station area to 10,000,000 cm. (7·854 sq. in.) in the neighbourhood of the station, and even with this great outlay there is much electrolytic trouble. The direction of flow is uninterrupted, and if the bonds were cut and the cables separated, the longer ones would bring back more current.

In order to split up the track into smaller areas additional sub-stations have in some cases been installed, but this is evidently uneconomical, as it is contrary to the tendency of modern practice, this being, as has been stated, to increase the capacity and not the number

* *Journal of the Western Society of Engineers*, vol. 15, p. 367, 1910.

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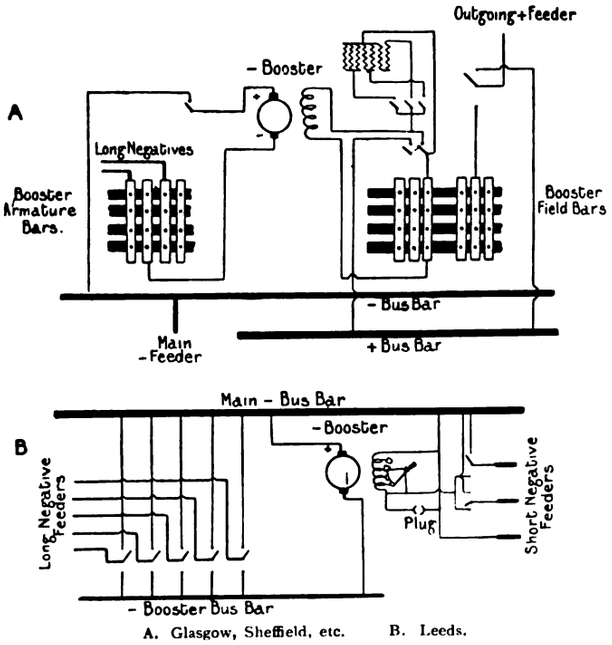
of sub-stations. Even with a greater number of sub-stations the difficulties are only alleviated; they are not necessarily removed.

By the use of negative boosters the track may be divided into definite feeding sections almost as perfectly as is the line, and the flow of current in the rails may be controlled in a manner which is almost ideal; but in the few cases in which negative boosters are in use this has not been done, no definite principle having been adopted, the boosters serving merely as a means of compelling long negative feeders to do their duty without excessive outlay in copper, the principles underlying the application being the same as in positive boosting.

Thus, Glasgow has a negative booster mounted on the shaft of each rotary converter at the sub-stations, and provision is made, as at Sheffield, for switching any booster on to any one of the long negative feeders, or on to a group of long negatives, as shown by the connections illustrated in Fig. 6, A. At Glasgow and Sheffield the negative boosters



A. Glasgow, Sheffield, etc. B. Leeds.

Fig. 6.—Negative Booster Connections.

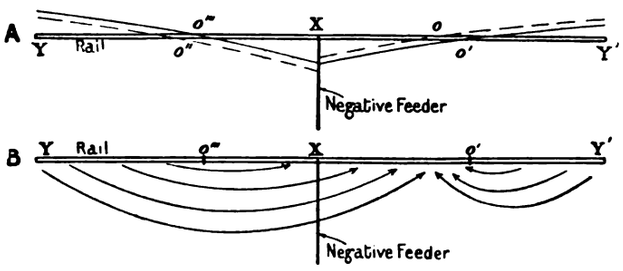
are excited from positive feeders, but at Leeds there is a large negative booster, capable of being switched on to a group of long negative feeders, excited from a shorter negative feeder, as shown in Fig. 6, B, whilst several smaller boosters, used on occasions of heavy traffic, are excited from positive feeders. A negative booster has been in use for some time at Birmingham in order to maintain the feed point on a route served by a long negative feeder at the same potential as that on another route fed by a shorter negative from the same station, whilst the authors know of no case of the use of negative boosters in America, and of only two cases—at Dantzig and Rouen—on the Continent. The application of the negative booster at Manchester on the principle of definite sectionalisation of the rails is discussed later.

Correct Principles of Negative Feeding.

In order to understand the correct principles of negative feeding it is necessary to study the effects on the flow of vagabond current of the various methods of feeding, since protection from electrolysis is the first object of the design.

With a uniformly distributed load, such as is approximately obtained with cars spaced at short intervals, the potential of the rails at any point with respect to the negative feed point is represented by a parabolic law, and if the curve of potential gradient in the rail is dropped until the two areas enclosed between it and the datum line are equal, as shown by the broken lines in Fig. 7, A, the area enclosed above the rail will represent the amount of vagabond current leaving the rail, whilst the area enclosed below the rail will represent the amount of current re-entering, the curve itself then representing the absolute potential of the rail, and also the vagabond current density, at any point, the point O of intersection being the point at which the rail is at normal earth potential.

The broken lines shown in Fig. 7, A, represent, neglecting any mutual effects, such curves of absolute potential for the two sub-sections of rail, the left-hand one of which is supposed to have (whether owing to greater length or to heavier loading is immaterial) a higher value of rail drop than the right-hand one. The point X, however, being common to the two sub-sections, must have a potential represented by a point on both curves which will accordingly be shifted to some positions such as those represented by the full lines, when it is evident that the two neutral points must be moved to the right and that there must be an interchange of vagabond current between the two sub-sections, as shown in Fig. 7, B. The higher rail drop will be reduced and the



In A—
Broken line = absolute potential gradients of sections considered independently
Full line = absolute potential gradients of sections considered jointly.

A. Mutual effects of unbalanced sections.
B. Interchange of vagabond currents between sections.

Fig. 7.—Unbalanced Sections.

lower one increased, the tendency being to reduce their values to equality.

In considering the absolute potential conditions of any sub-section full allowance must be made for the effects of other sections at a different absolute potential, and a sub-section may from this cause be rendered wholly negative with respect to earth, whilst safety and danger zones may be situated at totally unexpected places. Evidently then it is of importance that all sub-sections should have approximately the same value of rail drop, *i.e.*, that all negative feed points should be at the same absolute potential. This conclusion, based on the authors' researches into vagabond current phenomena described in a previous paper* also forms one of the recommendations of the recent joint Commission† representing the Verein von Gas- und Wasserfachmännern, the Verband Deutscher Electrotechniker, and the Verein Deutscher Strassenbahn-und Kleinbahn-Verwaltungen, which will govern future German practice.

For a given rail drop the authors have previously shown the vagabond current to be proportional roughly to the square of the length of sub-section, so that it is of importance that such length should be a minimum.

Ideal Negative Boosting.

The general use of negative boosters alone permits of the attainment of the two ideal conditions, viz.:

1. Uniform absolute potential at the negative feed points, and hence no interchange of vagabond current.
2. Minimum length of sub-section, and hence minimum vagabond current.

Further, full advantage is taken of the high conductivity of the track; the rail drop is easily maintained at a low value; the pressure loss in the negative feeders is no longer subtracted from the supply pressure; great potential-difference between the negative busbar and earth is avoided and, finally, with heavy loading a very material reduction may be obtained in the amount of return copper as compared with the amount required to obtain satisfactory conditions, even if they could possibly be obtained, without boosters. The saving in cost over the installation of additional sub-stations would be very considerable.

Economy in copper, however, must on no account be allowed to influence the amount of current to be brought back by any individual booster or the number of boosters to be employed. A maximum permissible value of rail drop must be adopted, and the amount of current to be returned must be determined solely by such rail drop considered in conjunction with the maximum intensity of loading and the specific conductivity of the track, with due allowance for increase of traffic, and it is in the determination of the booster voltage that the saving in copper may be balanced against the cost of dissipated energy.

The problem is—knowing the maximum and average intensities of loading at all points along the routes—to divide each route into negative feeding sections, each of such length that its own current flowing to its selected feed point shall split it up into two sub-sections having equal rail drop opposed in direction, as shown in Fig. 8, A, which illustrates the absolute potential gradients, and shows by means of arrows the direction of current flow in each of the sub-sections of rail of lengths L and *l* respectively, the conditions illustrated being applicable to sub-sections of equal lengths, equally loaded. This rail drop must have the same value on all sub-sections. Fig. 8, B, illustrates the conditions to be obtained in cases of unequal intensity of loading in the

* *Journal of the Institution of Electrical Engineers*, vol. 43, p. 449, 1909.
† *Electrotechnische Zeitschrift*, vol. 31, p. 491, 1910.

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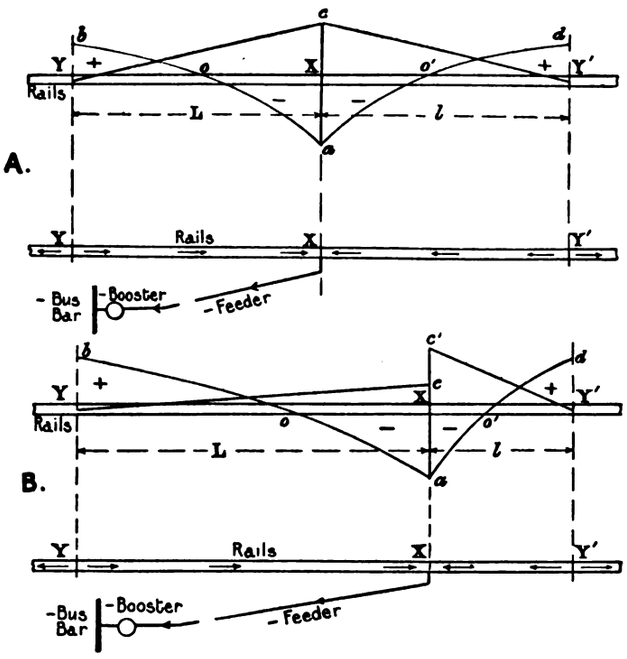
two sub-sections. The lengths L and l must each be such as to give the common rail drop, with their different conditions of loading, when



A. Uniform Loading of Sub-sections.

Index—
X = negative feed point.
Y, Y′ = artificial dividing points created by negative booster suction.
o, o′ = neutral points.
a o b, a o′ d = absolute potential gradients, and are identical.
Yc, Y′c = loading at any point in the rails.
L = l = length of sub-section.

B. Unbalanced Loading of Sub-sections.

L > l.
X c, X c′ = loading of sub-sections.
Y b, Y′d = absolute potentials at dividing points.
a = common absolute potential at negative feed point.

Fig. 8.—Negative Boosting Conditions.

there will be no interchange of vagabond current. The length of each sub-section may be determined by the following considerations:

Let—

i, I = maximum intensity of loading in amperes per mile on the respective sub-sections,

R = specific resistance of track in ohms per mile,

L, l = respective lengths of sub-sections in miles,

V = maximum permissible rail drop in volts.

Then—

$$V = \frac{i \cdot R \cdot L^2}{2} = \frac{I \cdot R \cdot l^2}{2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

$$\therefore L = \sqrt{\frac{2V}{i \cdot R}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

and—

$$l = \sqrt{\frac{2V}{I \cdot R}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

hence—

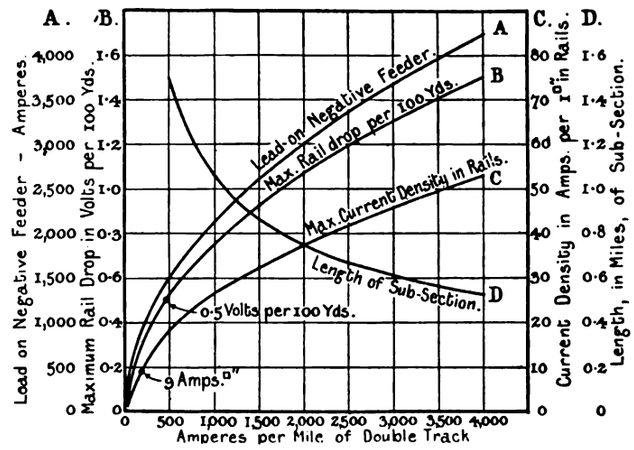
$$L : l :: \sqrt{I} : \sqrt{i} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

Typical values of the length L of sub-section and of the booster current, with two such sub-sections, are given in Fig. 9 for various intensities of loading with double track composed of 105 lb. rails of British standard section and corresponding to a rail drop of seven volts. The values of current show that the boosters would be quite large enough to justify a separate one to each negative feeder with heavy loading, whilst, if a higher rail drop than seven volts were allowed, or if rails of a heavier section were employed, both current and length of section would be larger, *i.e.*, the size of the boosters would be increased and their number reduced. The total length of section if the sub-section were equally loaded would be twice the value shown in Fig. 9.

In practice, however, the feeders would in the majority of cases be run to junctions, when the values given in Fig. 9 would be doubled, and the number of boosters almost halved, a slight sacrifice being made in the resulting conditions to effect this end. The ideal conditions could not in any case be perfectly obtained owing to imperfect distribution of the load, regulation of the boosters, etc., but the conditions actually attained would be greatly superior to the best that could be obtained in any other way. Many unboosted feeders could still be retained where favourably situated. Each booster should be excited from the grouped positive feeders serving the same area.

Combined Use of Negative Boosters and Unboosted Feeders.

The application of the negative booster is not likely to become sufficiently general to permit of the attainment of the ideal conditions, but the latter should be kept in mind. In the most general cases a booster is required either occasionally or continuously to operate a long negative feeder in parallel with shorter ones, and gives



Curve A. Total load on negative feeder—amperes.
" B. Max. pressure gradient in rails - volts per 100 yards.
" C. Max. current density in rails—amperes per square inch.
" D. Length of each sub-section in miles = L.
Total length of section = 2 L.
The curves apply to a maximum rail drop of 7 volts.

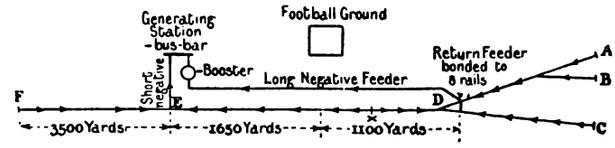
Note.—With a limit of 9 amperes per square inch the limit of loading is 200 amperes per mile.

Contrast above limits with the value of 4,000 amperes per mile taken from actual American practice, and upwards of 2,000 amperes per mile from British and Continental practice.

Fig. 9.—Negative Boosting.

satisfaction provided the permissible maximum rail drop is not exceeded.

An installation of this kind, designed by the authors to deal with very heavy football traffic, is illustrated in Fig. 10. The heavy loading was experienced between the football ground shown and the boundary at A, B, C, and the rail drop between these points, and the point D was found to be below seven volts. The negative booster was so designed that an artificial dividing point was created at X, and moved with varying load distribution over a range such that it never reached the point D of attachment of the boosted feeder. In this way the section was split up into three sub-sections, the direction of flow of current in each being indicated by the arrows. The rail drop in each sub-section was maintained below six volts, and although the total drop from D to E could not be reduced to zero—the ideal value—it was reduced to two volts as against 18 volts without the boosted feeder. This imperfect balance



A, B, C, and F = boundaries of system.
D and E = negative feed points.
Line previously supplied by E only.
All double track.

Fig. 10.—Negative Boosting.

was due to the loading of the sub-section E F, which was beyond the control of the booster. In this way alone, by splitting up the section into sub-sections with their directions of flow mutually opposed under all conditions of loading, could the rail drop under such difficult conditions be maintained below seven volts. The practice of connecting a group of long negative feeders to a single booster would not be possible with really heavy loading, nor would that of exciting the booster from a shorter negative feeder, and in any case with such methods the track sectionalisation is not definitely assured.

Superimposed Return Circuits.

The authors have known cases where return current from a section fed by long feeders from one station entered another station by its negative feeder, flowed through its generators along its trolley wires, and through the equipments of its distant cars to re-enter the former

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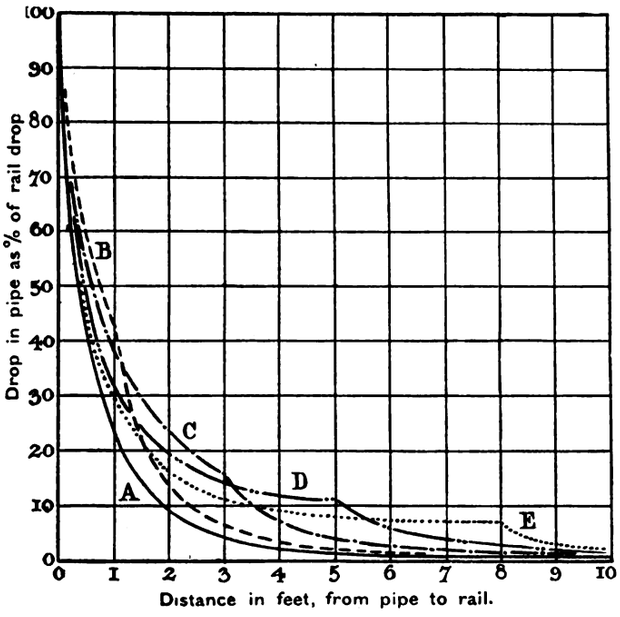
station by a shorter negative feeder on another route. This would not occur if the potential at the negative feed points were uniform, and cannot be prevented by merely equalising the resistances of the negative feeders, although it can be minimised, since such equalising is correct for one value only of the load distribution. With boosters it is correct for all values.

LEGISLATION.

It has been shown by the authors in their previous paper that one regulation alone is of any use in assisting in the prevention of electrolysis, viz., limitation of the maximum permissible rail drop, and other regulations are not merely useless, and often contradictory, but may impede progress. Thus, for instance, for a given rail drop the potential difference between the rail and a pipe at any point is definitely fixed and beyond control.

There are two regulations in particular which would effectually prevent the use of the ideal system of negative boosting, viz., the British limit of 9 amperes per square inch, in current density in the rails, and the present Chicago limit of steepness of potential gradient in the rails, which must not exceed 1 volt per 1,000 ft. in the down town sections and 1 volt per 700 ft. in other places. The latter is a reflection of the old French administrative rule of 1 volt per kilometre also adopted for suburban lines by the German Commission.

The maximum values of current density and rate of fall of potential in the rail with the ideal boosting conditions, British standard 105-lb. rails and 7-volt rail drop, are illustrated by the curves B and C given in Fig. 9, whence it is obvious that the above values would be far too low. And yet the conditions in Fig. 9 represent the maximum of safety. The limitation of current density in the rails has been adopted as the



A. Pipe and rails in soils free from electrolytes.
B. Ground impregnated for 12 in. round rail with strong electrolyte.
C. As B, but electrolyte extending 36 in.
D. As B, but electrolyte extending 60 in.
E. As B, but electrolyte extending 96 in.

Note.—Curve A represents the general case, the other cases being very exceptional with standard track construction.

Fig. 11.—Voltage Drop in a Pipe in Terms of the Rail Drop, and Distances from Rail.

most practical way of limiting the local steepness of the potential gradient to a maximum of 0·5 volt per 100 yds., so that the two regulations are really identical in nature and are based on the fear that with a potential difference of, say, 1 volt per 100 yards, there would be a heavy flow of current in any metallic structure which happened to approach the rails at two points several hundred yards apart. It is clear, however, from the curves shown in Fig. 8, that these high values are obtained only in the neighbourhood of the negative feed points, where at no single point could current leave the rails, and the danger is purely imaginary

It is widely believed that with very heavy loading the British limit of 7-volt rail drop would be prohibitive, but with negative boosting this would not be the case. The German Commission already referred to recommends a maximum value of 2·5 volts, but this is too low, as the 7-volt limit has proved to be a reasonable insurance against damage, which is all that should be expected. A value recently incorporated into the city ordinances at Chicago of 12 volts maximum is considered very harsh, but the curves given in Fig. 11 show that the pressure drop along a pipe situated within 3 ft. of the rails may easily exceed 10 per cent. of the total rail drop, and so values greatly in excess of 7 volts are not to be encouraged.

CONSTRUCTION.

Legislation alone cannot provide complete protection against electrolysis. It must be assisted by careful construction. Metallic structures must not approach within 3 ft. of the rails (the German Commission recommends one metre), and in new construction or reconstruction care must be taken to reduce to a minimum the number of section box frames, poles, etc., which require to be bonded to the rails, as these pass down amongst the pipes beneath the footpath.

Guard wires ought to be insulated from the poles and "earthed" by means of insulated cables passing down the interior of the poles to the rails, and poles carrying gas-lamps ought to have triple insulation rather than to be bonded to the track, as the latter is equivalent to bonding the pipes themselves to the track, which is bad practice.

The authors wish again to express their indebtedness to Mr J. M. McElroy, general manager of the Manchester Corporation Tramways, for the generous facilities provided for experimental research, and to Mr. S. L. Pearce, chief electrical engineer, and Messrs. A. E. McKenzie, L. R. Lee, and H. A. Ratcliff, of the staff of the Manchester Corporation Electricity Department, and others.

MELBOURNE SUBURBAN RAILWAY ELECTRIFICATION.

The Lower House of the Victoria Legislative Assembly, on December 11, passed the bill providing for the eletrification of Melbourne suburban railways in accordance with the report of Messrs. Merz and McClellan, a full summary of which appeared in our issue of December 12. The division took place at 4 a.m., 38 members voting in favour of the scheme and only five against. The House consists of only 65 members, and the large proportion of members voting at the end of an all-night sitting indicates the interest which is being taken in the proposed conversion of the steam railways to electric traction. The bill was passed by the Upper House on December 20, and the contracts will be arranged without delay. As intimated in our issue of November 9, it is understood that the contract for turbines and electrical equipment will be placed with a British firm.

THE LIGHT RAILWAYS BILL.

The Light Railways Bill passed through the Committee stage without amendment in the House of Lords on December 10. Lord Clifford of Chudleigh tried to have the clause regarding the trackless trolley system (which was dropped by the Government when the bill was before the House of Commons) reinserted in the bill. He objected to the present arrangement under which trackless trolley schemes have to be promoted by private bills in Parliament, because when county councils wish to oppose they have to incur the expense of opposing the bills before Parliamentary Committees. The Earl of Granard, on behalf of the Government, opposed the amendment, and pointed out that the clause had met with great opposition in the House of Commons, and if it was reintroduced into the bill the measure might be lost. The municipalities were opposed to the clause. He also pointed out that the clause would penalise one form of locomotion by making it liable for road maintenance, while other forms went free. The amendment was rejected by 30 votes to 17. On December 11 the bill was read a third time, and it received the Royal Assent three days later.

The British Electrical and Allied Manufacturers' Association (Incorporated).—By the courtesy of the Council of the Institution of Electrical Engineers, the annual general meeting of this Association will be held in the Lecture Theatre of the Institution, Victoria Embankment, London, on Friday, January 24. The annual dinner will be held in the evening, when Lord Ampthill will preside.

Annual Convention of the I.M.E.A.—The eighteenth annual convention of the I.M.E.A. will be held in London from June 17 to 20, 1913. The Council of the Institution of Electrical Engineers have placed the Institution premises at the disposal of the Association for meetings, and the head-quarters will be the Hotel Cecil.

Opposition for Cape Town Tramways Company.—It is understood that the Cape Government will electrify the short railway line from Cape Town to Sea Point if the Sea Point Municipality will pay £13,000 down. The railway is at present run under a guarantee of the municipality, which involves the ratepayers in a charge of about £6,000 a year. The line, when electrified, would be worked in competition with that of the Cape Town Tramways Company.

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THE "CELERITY" RAIL GRINDER.

(Contributed.)

In the regular maintenance of track it is necessary frequently to grind down inequalities in the rails, and great difficulties have hitherto been experienced in carrying out this work. The rail grinders introduced so far have been expensive, the lowest price being close upon £100, and extending upwards in cost to seven or eight times this amount—prices which were almost prohibitive to the smaller systems, and even on the larger ones prevented a sufficient number being obtained to give that attention which efficient track maintenance demands. With regard to usage also, many difficulties prevented grinders being used with the freedom required.

In the case of the cheaper types, the power was mainly external to the grinder, and was applied by means of a flexible shaft connected to a motor fixed upon an independent truck, the shaft and truck blocking the ordinary highway traffic on the roadside. In others, although motor and grinding wheel were fixed on the same base frame, the power was still applied by the flexible shaft, and only those who have had experience of the trouble and cost of maintaining these shafts can appreciate the difficulties of this type. Again, in the manipulation, many inconveniences were apparent, an operator in some instances having to bend quite double. All the very costly, and some of the more moderately priced machines, were designed to work on a carriage mounted on flanged wheels which ran on the tram lines, and obviously these could only be worked when the car traffic was stopped.

The grinding of tram rails is, or should be, one of the most delicate operations which has to be undertaken in connection with tramway work. Considering that much of the grinding to be done must not

exceed $\frac{1}{100}$th part of an inch in depth and the generality of it averaging not more than $\frac{1}{32}$nd part of an inch, and that to be successful it should die out imperceptibly at about 15 in. away on either side, it will be readily granted that the fineness of the work is such that it can only be carried out properly in the best light obtainable and is therefore no fit subject for night work.

In the majority of the grinders used the adjustment of the grinding wheel has been by means of hand wheels attached to feed screws, a method utterly inadequate for outdoor track work.

The "Celerity" grinding machine, on the other hand, will grind out corrugation or any other defect at the rate of about 10 to 18 ft. an hour, according to its depth and freedom from interference by traffic. For this machine it is claimed that the whole of the disadvantages in the other types have been overcome.

Among the points put forward in its favour are that it can be supplied at a cost nearly half that of any other rail grinder. It is very light, only weighing about $3\frac{3}{4}$ cwt. complete. The motor is balanced over the front running wheel so as to give only the requisite pressure for the grinding wheel and relieve the operator as much as possible. It can be easily wheeled along the tram lines by one man, or placed on a car front. Street obstruction is reduced to a minimum, as a width of only about 2 ft. is used.

The power is obtained direct from the overhead wire, and as the motor is close to its work a $1\frac{1}{2}$-H.P. motor is sufficient to drive the grinding wheel, the power being transmitted by belts. One man only operates the machine, hence the machine and his intentions can work in complete unison. The operator stands in an easy upright position. The starter and switch are close to his hands, and the machine can be stopped instantly by himself without the necessity of informing someone else. As one rail only is occupied at a time the machine is easily taken off the track out of the way of passing cars and quickly put on again, only about a minute or so being lost by an expert grinder each time a car passes. As one man only is required to operate the machine, with the assistance of a sharp youth to warn the traffic clear of the operator and remove the trolley attachment when cars pass and refix after, the labour costs are about half of those of any other machine.

The machine, being of a mono-rail type, with practically a one-wheel run, its bearing is obtained instantly, and for adjustment it is well known that nothing is so sensitive as the human sense of touch, and it is this sense which is relied upon with perfect safety to conduct either the deeper or lightest "cuts." The second wheel is merely provided to carry the frame, and is fitted with an adjustable spring sufficiently powerful to lift the grinding wheel clear off the rail immediately the pressure of the hands is removed, so that the depth of "cut" is regulated by the pressure of the hands on the shafts. The automatic cut-out in connection with the starter is so arranged that if the operator attempts to take a deeper "cut" than is advisable, it automatically shuts off the current and stops the machine. By a slight tilting of the machine, one side of the rail can be ground more than the other if desired.

NEW AND PROSPECTIVE WORK.

BANGALORE.—Orders are to be placed in Europe and America for plant and materials required for the construction of tramways for Bangalore. The project is expected to be completed in 13 months.

BOURNEMOUTH.—During the latter part of 1913 the permanent way from Winton to the cemetery, from King's Road to the cemetery, and from the cemetery to Richmond Hill is to be relaid as double lines.

GLASGOW.—Members of the City Council have made a motor car tour of the districts for which it is suggested that the Tramways Committee should consider the desirability of providing tramway extensions, viz., North Kelvinside, Canniesburn and Milngavie, Temple, Scotstounhill, Govan, Sinclair Drive, Netherlee, Clarkston, Whitecraigs, Provanmill, Millerston, Coatbridge, Cathkin, Baillieston to Coatbridge, Riddrie to Millerston, and Garngad to Provanmill. The committee have since recommended tramways for several of these localities.

HUDDERSFIELD.—The Council at a special meeting authorised the promotion of a bill for the construction of further tramways in the borough, in the borough of Brighouse, and in the urban districts of Elland, Greetland, Slaithwaite, Linthwaite, and Marsden, and parish of Fixby in the rural district of Halifax, in the West Riding of the County of York: also to run railless trolley cars and omnibuses.

NOTTINGHAM.—The Council on December 2 approved of the bill for empowering the Corporation to run motor 'buses or railless trolley vehicles from Beast Market Hill through West Bridgford by three routes—Radcliffe Road and Trent Boulevard, Musters Road and Chaworth Road, and Loughborough Road. Powers are also sought to extend the existing tramways from the junction of Derby Road and Lenton Boulevard as far as Wollaton Park entrance, and also to run motor 'buses anywhere within the city, and to extend such service to Cariton, Daybrook, Arnold, and along the Mapperley Plains road.

NOTTS AND DERBYSHIRE.—Ripley Council, after meeting representatives of the Notts and Derbyshire Tramways Company, have passed the plans providing for a tramway service to Ripley, with a terminus in Grosvenor Road. The company have notified this and other local authorities of their intention to begin the work of construction.

ROTHERHAM.—A sub-committee of the Tramways Committee has been appointed to consider and report upon the question of extending the car shed accommodation at Rawmarsh.

SAN JUAN.—Messrs. J. G. White and Company have applied to the Legislature of the province of San Juan for a concession to make use of the various water powers in the province for electric power-stations, which would embrace nearly the whole of the province.

LEEDS.—A special meeting of the City Council recently approved the promotion of a bill next session for the extension of the tramways from the present terminus in York Road along Selby Road as far as Hollyshaw Lane, and from the same terminus along York Road to "a point opposite to the intersection of the bridle path to Crossgates and York Road." Railless trolley car proposals were also sanctioned. The voting was equal on a motion, proposed by Alderman R. A. Smithson, chairman of the Parliamentary Committee, for the deletion of the clause to empower the Council to acquire lands in the city, and to erect an electrical generating station, refuse destructor, and other works. As it was necessary that the clause should be approved by at least 35 votes of members, this portion of the bill automatically fell through. Alderman Smithson urged that neither the public nor the department would suffer by a delay of 12 months, during which time expert advice could be obtained.

Birmingham Queues.—Although definite arrival places for the three routes ending in Martineau Street have been appointed, and large electric signs have been erected to denote them, Birmingham people do not yet preserve the queues during the mid-day and evening rush traffic. The difficulty is that the department have no power to enforce the strict observance of the queue order, and that one policeman cannot watch three lines of people at once. At the Hill Street and Navigation Street termini proper shelters are placed to regulate the crowds waiting, but in Martineau Street the pavement is not wide enough to permit of such an arrangement.

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FINANCIAL REPORTS AND MEETINGS.

Bristol Carriage and Wagon Company.—An interim dividend of 2 per cent. is announced.

Hobart Electric Tramways.—An interim dividend of 9d. per share, free of income tax, has been declared.

National Steam Car Company.—The directors recommend a dividend of 10 per cent. on the £100,000 old shares in respect of the year ended October 31.

Melbourne Tramway and Omnibus Company.—A dividend is announced at the rate of 20 per cent. per annum (6d. per share) for the quarter ending December 31.

British Electric Traction Dividend.—The directors have declared the dividend for the half-year to September 30 on the six per cent. cumulative preference stock.

J. G. White and Company, Limited.—The directors have declared an interim dividend at the rate of 12 per cent. per annum on the ordinary shares for the past half-year.

Winnipeg Electric Railway.—The board announce a quarterly dividend on the capital stock (exclusive of the recent issue of new shares) at the rate of 12 per cent. per annum.

United Electric Trams of Monte Video.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (3s. per share), less income tax, on the ordinary shares for the half-year to September 30.

Yorkshire (West Riding) Electric Tramways Company.—On account of the dividends accrued to December 31, 1912, a dividend will be paid on the 6 per cent. cumulative preference shares at the rate of 3 per cent. per annum.

Lima Light, Power, and Tramways Company.—A dividend of 1¼ per cent. has been declared in Lima on the shares for the third quarter of the current year (ended September 30, 1912), payable against coupon No. 3, on and after December 2.

Canadian General Electric Company.—A quarterly dividend of 1¾ per cent. has been declared, together with a bonus of 1 per cent., both payable on January 1. This makes a total distribution of 8 per cent. for the year ending December 31.

Cordoba Light, Power, and Traction Company. — The accounts for the year ended September 30 show a net profit of £42,630, out of which the directors recommend a dividend of 5 per cent., as compared with 4 per cent. for the previous year, carrying forward £12,630.

Manx Electric Railway Company, Limited. — Sir A. G. Boscawen, M.P., presiding at the general meeting on December 17, said that the passenger receipts were £2,253 less than in the previous year, owing mainly to the inclemency of the weather. Goods and other receipts showed an increase of £615, but working expenses were up by £455, due to the higher price of coal.

M.E.T. Capital Reduced.—In the Chancery Division, on December 10, Mr. Justice Neville heard the petition of the Metropolitan Electric Tramways, Limited, for confirmation of reduction of the capital of the company from £1,500,000 to £1,078,504. Counsel said that a sum of £231,000 was not represented by available assets, and his Lordship confirmed the reduction.

Canadian Car and Foundry.—The sales for the year ended September 30 were $16,500,000, and the profits available for dividend purposes, after providing for the first instalment of the bond sinking fund, $1,040,000. At the close of the fiscal year the unfilled orders amounted in value to over $15,000,000. Two semi-annual dividends of 2 per cent. each have been declared upon the common shares.

Mechanical Traction for Lancaster and District Tramways.—At the annual meeting of the company on December 8, the chairman (Mr. A. Bell) announced that the directors had given notice of an application to the Board of Trade for an order to authorise them to adopt some form of mechanical traction. The line had been inspected by Colonel Drewitt, one of the inspectors of the Board, but they had not yet received his report. The profit on the year's working was £812, or £600 less than in the previous year.

Increased Assessments at Northampton. — The Tramways Committee have reported that in consequence of the large increase of the rating assessment, the cost of coal, and wages for the past year, it is not expected that the net revenue of the undertaking would approach within £2,000 of that previously earned. In consequence, they have adjourned the consideration of the issue of penny return tickets until the results of the year's working are known.

Lancaster Tramways Company.—The annual report shows a decrease in receipts of £281 as compared with the previous year. The result of the year's working is a profit of £812. The number of miles run has been 85,544, as against 85,280, and the number of passengers carried 449,189, as compared with 465,157 last year, showing an increase of 264 miles and a decrease of 15,968 passengers. The receipts per mile have been 15·02d., as compared with 15·88d., and the expenditure 13·24d., compared with 12·65d. last year.

Llandudno and Colwyn Bay Electric Railway.—The report for the year to November 30, 1912, shows that the profit, after providing for operating and administration expenses and interest on debenture stock, amounted to £6,023. The amount brought forward was £714, making a total balance of £6,737. After allowing for depreciation reserve and debenture issue expenses, the directors recommended that the balance of £4,737 should be applied as follows: Dividend at the rate of 3½ per cent. per annum, £3,479, leaving to be carried forward £1,258.

Imperial Tramways Company and the London Amalgamations.—Sir George White, chairman of the Imperial Tramways Company, Bristol, in a letter issued to the shareholders, has stated that the company are large holders of the London United Tramways Company's preference capital. The directors have resolved to approve of the consolidation scheme between that company, the Metropolitan Tramways Company, and the London General Omnibus Company, believing that when it is carried through payment of dividends on the preference and ordinary shares of the Imperial Company will be resumed at an early date.

Value of Hastings Tramways to the Ratepayers.—Replying to questions put at a meeting of the Council, the borough accountant stated that the present total amount, which is the maximum, paid in wayleaves by the Tramways Company was £1,415 9s. For the sea front line, which the company propose to convert from surface-contact to trolley traction, the sum of £735 is paid annually. This is at the rate of £400 per mile. For watering points £5 per annum is paid, besides £136 18s. for water measured by meter, and £2 per annum for water used in repairing tracks. The sum paid in rates during the year ended September 30 last was £1,027.

Oldham Corporation Tramways.—The report of Mr. J. W. Dugdale, general manager of Oldham Corporation Tramways, for the year ended March 25, 1912, shows a satisfactory growth in receipts from £97,842 in 1911 to £102,099. Working expenses amounted to £71,184 (against £69,576), gross profits being £30,914 Adding bank interest, the total receipts amounted to £32,283, leaving a deficiency of £2,413. Car-mileage amounted to 1,942,147; passengers carried, 20,073,483. Energy consumption per car-mile was 1·823 units; percentage of working expenses to receipts, 69·72; total revenue per car-mile 12·616d.; and the average working expenses, 8·796d. During the past year 15 days, in addition to any holidays to which they were entitled, have been granted to all employees in the Territorials, to enable them to attend camp for their annual training. A useful change has been the substitution of a motor tower wagon in place of the horse vehicle hitherto used. The system was closed by a strike from August 16 to August 21 (four days) owing to an "alleged importation of officials."

Blackpool, St. Anne's, and Lytham Tramways Unsatisfactory Year.—The directors report that the unsettled summer resulted in a diminution of traffic amounting to £2,480, although up to May there was an increase of £1,000. After payment of debenture interest, the debit balance to profit and loss account stands at £30,160. There is an increase in the expenditure, arising upon the upkeep of the permanent way, and in view of the condition of some portions of the track there is no likelihood of this expenditure being reduced in the immediate future; in fact, a considerable portion of the line in Lytham requires relaying, and this work should be undertaken during the current year. Mr. T. Blane, who presided at the annual meeting on December 23, stated that the debenture holders were entitled to the line until they were paid out, and because of the cost of the line and the great amount of interest in arrears he thought there was no chance of the shareholders getting a penny. A committee of shareholders were appointed to confer with the directors, the chairman remarking that as the undertaking was in the hands of a receiver for the debenture holders the shareholders were powerless.

Power-Gas Corporation and Railway Electrification.—Sir Alfred Mond, M.P., in moving the adoption of the report and the payment of a dividend of 4 per cent. on the ordinary shares of the Power-Gas Corporation, Limited, stated that owing to the miners' strike the business had been greatly retarded. Northwich had for many years given the cheapest supply of electricity in the country from their Mond gas plant. Wednesbury Council, who were on the system of the South Staffordshire Mond Gas Company, were distributing 1,500 H.P. in electricity, and a municipal station in Lancashire had just started a 2,000-H.P. plant with ammonia recovery for electricity work, and had had the courage to put up 2,000 brake horse-power National gas engines. He had no doubt other central station engineers and local authorities would follow suit. The company were carrying out a large contract for the Japanese Imperial Railway Company, who were electrifying part of their railway. He had no doubt the time would not be long when English railway engineers would have to go to Japan in order to study electrification in an up-to-date style, and come back having learned what they could have acquired here years ago.

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TRAMWAY AND OMNIBUS SHARE LIST.

Specially Compiled for "The Tramway and Railway World."

Amount Ranking for Dividend.	Shares.	Name.	Div'd. Prev. Half-year.	Div'd. Last Half-year.	Quotations, Dec. 31.	Movement During Dec. Rise.	Movement During Dec. Fall.	Latest Business Done. Price.	Latest Business Done. Date.	Yield on Buying Price. £ s. d.	Dividend Due. (Final in Italics.)	Quotations, Jan., 1908, to Dec. 31, 1912. Highest	Quotations, Jan., 1908, to Dec. 31, 1912. Lowest
640,000	5	Anglo-Argentine Tramways 5½% Cum. 1st Pref.	2/9	2/9	4¾—5xd	...	...	5 5/32	Dec. 24	5 10 9	Jan., Dec.	5 17/32	4¼
500,000	5	Do. do. 5½% Cum. 2nd Pref.	2/9	2/9	4⅝—4¾xd	...	...	98/9	Dec. 20	5 15 9	June, *Dec.*	5 1/32	4 1/16
1,500,000£	...	Do. do. 5% Deb. Stock Red.	5%	5%	98—100	+ 1	...	99½	Dec. 31	5 0 0	June, Dec.	105½	96
325,532£	Stk.	Auckland Elec. Trys. Co. 5% Mort. Deb.	5%	5%	101—103xd	...	...	105½	Dec. 17	4 17 3	Jan., July.	107	101
75,000	1	Bath Electric Tramways 5% Cum. Pref.	6d.	6d.	11/16—13/16xd	...	...	14/6	Dec. 31	6 3 3	*Jan.* & July	1 9/16	7/16
334,696£	Stk.	Birmingham Dist. Pow. & Tract. 4½% 1st Deb.	4½%	4½%	89—91xd	...	...	91½	Dec. 17	4 19 0	Jan., July.	96	77
15,000	10	Blackpool and Fleetwood Tramways	11/-	4/-	14¼—14½	...	...	14¾	Dec. 18	5 3 6	Feb., Aug.	14½	12
60,000	10	Bombay Elec. Supply & Trys. Co. 6% Cum. Pref.	6/-	6/-	11½—12¼	...	...	11¾	Nov. 19	4 18 0	Feb., Aug.	12¼	7¾
75,000	5	Brisbane Elec. Tramways Investment Co. Ord.	4/-	4/-	7 1/16—7 5/16	...	...	7⅛	Dec. 30	5 9 6	*May*, Oct.	9⅛	3 3/16
75,000	5	Do. do. do. 5% Cum. Pref.	2/6	2/6	4⅛—5¼	...	...	5⅛	Dec. 16	4 15 3	*May*, Nov.	5⅝	4⅜
50,000	10	Bristol Tramways and Carriage Co.	4	4	6¾—6⅞	+ ¼	...	5⅛	Nov. 9/10	6 0 9	*Feb.*, Aug.	14¼	5
50,000	10	Do. do. do. 4% Cum. Pref.	4	4	7¼—7½xd	...	...	7	Sept. 30	5 6 9	Jan., July.	9¼	6¾
800,000£	Stk.	British Columbia Electric Railway Def. Ord.	8%	for '11	139—144	...	— 5	141½	Dec. 31	5 11 3	May, Nov.	156	123
800,000£	Stk	Do. do. Pref. Ord.	6%	6%	118—122	...	...	121	Dec. 31	5 0 6	May, Nov.	132½	105
800,000£	Stk	Do. do. 5% Cum. Perp. Pref.	5%	5%	107—110	...	...	108¾	Dec. 31	4 13 0	May, Nov.	114	99
1,070,097£	Stk.	British Electric Traction Prefd. Ord.	...	...	11½—13½	...	...	12	Dec. 31	...	Apr., *Oct.*	16	10½
403,503£	Stk.	Do. do. 6% Cum. Pref.	6%	6%	87—90	...	...	88½	Dec. 24	6 13 6	Feb., *Aug.*	95¼	86½
1,464,245£	Stk.	Do. do. 5% Perp. Deb.	5%	5%	92—96	...	...	93	Dec. 23	5 4 3	April, Oct.	101	82½
439,796£	Stk.	Do. do. 4½% 2nd Deb. Red.	4½%	4½%	77—81	...	...	77½	Dec. 23	5 11 3	Jan., July.	84	58
246,625£	Stk.	Buenos Aires Port & City Trys. 6% 1st Mt. Deb.	6%	6%	94—98	...	...	95	Dec. 17	6 5 0	Feb., Aug.	103	61
623,270£	Stk.	Buenos Ayres Lacroze Trys. Stg. 5% 1st Mt Deb.	5%	5%	99½—101½	...	...	100¾	Dec. 28	4 19 0	Mar., Sept.	103	89
137,610	5	Calcutta Tramways Ord.	4/6	2/6	5¾—6⅛	...	— ¼	5 31/32	Dec. 16	5 14 3	*Apr.*, Oct.	7¼	4
47,295	5	Do. 5% Cum. Pref.	2/6	2/6	4 13/16—5 1/16xd	...	...	5 1/16	Dec. 5	4 18 9	Jan., July	5⅜	4⅜
491,222	1	Cape Electric Tramways	1/-	for '12	¾—¾	...	...	14/9	Dec. 4	6 13 6	Feb., *Nov.*	1 3/16	⅛
15,000	10	Carthagena and Herrerias Steam Tramways	5/-	for '11	2¾—3½	...	— ½	65/-	Nov. 21	...	April.	7	3
40,000	5	City of Birmingham Tramways 5% Cum. Pref.	2/6	2/6	...	...	...	5 9/16	Oct. 11	...	*Apr.*, Oct.	5⅞	4⅛
248,000	5	City of Buenos Ayres Tramways (1904)	2/6	2/6	5 7/16—5 11/16	...	...	5 7/16	Dec. 24	4 8 0	Fe My.Au No	6	5⅛
120,000£	Stk.	Colombo Elec. Trys. & Ltg. 5% 1st Mt. Deb.	5%	5%	93—97	...	...	96	Dec. 13	5 3 3	May, Nov.	101	87
11,500	10	Cork Electric Tramways and Lighting Co.	...	8/- ann.	4½—5	...	...	4 15/32	Dec. 23	2 0 0	*Mar.*	10	4½
12,327	10	Do. do. do. 5% Cum Pref.	5/-	5/-	7½—8	...	...	8	July 22	6 5 0	Jan., July	10¾	7½
3,000	10	Dublin and Lucan Elec. Railway 5% Cum. Pref.	5/-	5/-	8¾—9½	...	...	9	Aug. 25/10	5 8 3	Sep.15, Mar.15	9¼	8¾
60,000	10	Dublin United Tramways Co. (1896), Ltd., Ord.	7/-	6/-	11½—11¾	...	...	11 9/16	Dec. 31	5 10 9	Feb., Aug.	14	11½
60,000	10	Do. do. do. 6% Cum. Pref.	6/-	6/-	12—13	...	...	12 7/16	Dec. 31	4 12 6	*Feb.*, Aug.	14	11½
13,500	10	Gateshead & District Trys. Co. Ord.	7/-	5/-	8½—8¾	...	...	8⅜	Sept. 27	6 17 3	*Mar.*, Sept.	9¼	7⅞
204,353	4	General Motor Cab Co., Pref. Ord.	2/9⅜	...	...	...	...	6/-	June 17	...	...	3¾	⅛
268,235	10/-	Hastings and District Elec. Trys. Ord.	...	...	7/32—9/32	...	...	1/9	Jan. 5	...	...	3/16	1/16
80,000	1	Do. do. 6% Cum. Pref.	6%	6%	15/16—23/32	...	...	12/6	June 6	8 7 0	...	¼	15/32
125,000£	Stk.	Do. do. 4½% Deb. Stk. Red.	4½	4½	69—74	...	...	73½	Feb. 8	6 1 9	April, Oct.	100	69
$9,634,000	$1,000	Havana Elec. Rly. Co. Con. Mort. 5%	5%	5%	99—103	...	...	100	Dec. 23	4 19 6	Feb., Aug	105	80
195,000£	100	Hong Kong Tramways Co. 5% Mt. Deb.	5%	5%	86—90	...	...	86½	Dec. 13	5 11 3	May, Nov.	92	75½
20,000	10	Imperial Tramways Ord.	Nil	Nil	4½—4¾	+ ¾	...	9¾	Oct. 29/09	...	Feb., Aug.	9¾	2¼
20,000	10	Do. 6% Cum. Pref.	Nil	Nil	8—8½	+ 1	...	6 3/32	Ju. 28/09	...	Jan., July.	9½	2¾
30,000	5	Isle of Thanet Elec.Try.& Ltg. Co.5% Cum.Pref.	2/6	Dec. '12	2⅛—2⅝	...	...	46/3	Nov. 30	4 15 3	*Mar.*, Sept.	3	¾
250,000	1	Kalgoorlie Electric Tramways	...	...	1/32—3/32	...	...	1/-	Jan 15	...	*May*	¾ 1/16	1/32
170,000	1	La Plata Elec. Trys. Co. 6% Cum. Pref.	7½d.	7½d.	29/32—1	...	...	18/9	July 8	6 0 0	*April*. Oct.	1 1/16	¼
30,800	10	Lanarkshire Tramways	6/6	5/6	9¾—10¼	...	...	10	May 27	5 17 3	Feb., Aug.	10 9/16	9⅝
250,000£	Stk.	Lancashire United Trys. 5% Prior Lien Deb.	5%	5%	78—80xd	...	...	81½	Nov. 28	6 5 0	Jan., July.	95	79
634,026	1	Lisbon Electric Tramways Ord.	7½d.	7½d.	1 1/16—1 3/16	...	...	21/3	Dec. 11	5 1 3	*July.*	1 9/32	⅞
425,553	1	Do. do. 6% Cum. Pref	7½d.	7½d.	1 1/16—1 1/16xd	...	...	22/6	Oct. 8	5 1 3	Jan., July.	1¼	13/16
1,000,000£	Stk.	London General Omnibus 4½% 1st Deb.	...	...	94—96	...	— ½	95¼	Dec. 31	4 13 9	...	96½	95¼
1,000,000£	Stk.	Do. do. 5% Cum. Income	...	...	91—93	...	— 1	92½	Dec. 31	5 7 6	...	94	90
125,000	10	London United Trys. (1901), Ltd., 5% Cum. Pref.	2/6	Dec.' 08	5¼—5¾	...	...	5⅛	Dec. 5	...	*Jan.*, July.	8½	1⅜
63,430£	Stk.	Madras Elec. Trys. (1904) Ltd. 5% Deb. Red.	5%	5%	98—100	...	...	96	Dec. 19	5 0 0	Jan., July.	102	86
300,000£	100	Manaos Trys. & Ltg. Co. 5% 1st Debs.	5%	5%	89—92	...	— 1	89½	Dec. 27	5 11 3	Jan., July.	97	86
$4,785,000	$1,000	Manila Elec. R. R. and Ltg. Corp. 5% Gld. Bds.	5%	5%	100½—102½	...	...	102¼	Dec. 12	4 18 6	Mar., Sept.	104⅜	84
60,000	1	Mansfield & District Trys. Ltd. 6% Cum. Pref.	7½d.	7½d.	29/32—1 1/32	...	...	19/3	Sept. 5	5 16 6	Mar., Sept.	1 1/32	¾
395,832	1	Metropolitan Electric Tramways Ord.	7	5	1 1/16—1 1/16	...	— ⅛	21/3	Dec. 10	5 1 3	*April*, Oct.	1⅜	⅝
314,016	1	Do. do. do. Def.	...	...	½—5/16	...	...	4/9	Dec. 10	...	...	6/6	3/32
500,000	1	Do. do. do. 5% Cum. Pref.	6d.	6d.	¾—⅞	...	...	10/6	Dec. 12	5 14 3	*Feb.*, Aug.	1 1/32	11/16
$16,487,400	$100	Mexico Tramways Common Stock	$3½	$3½	111—113	...	— 2	112¾	Dec. 30	6 7 0	Fb.My.Au No	151½	65
$3,840,000	...	Michigan Untd Rys. Co. 5% 1st Debs & Refdg Bds	5%	5%	95½—95⅞	...	— ½	94¼	Dec. 4	5 8 6	May, Nov.	101½	92¼
140,000£	100	Montreal Street Rly. 4½% Ster. Debs.	4½%	4½%	100—102	+ 1	...	101	Dec. 2	4 10 0	Fe.My.Au.No.	107	99
5,000	10	Oldham, Ashton, and Hyde Elec. Tramways Ord.	7/-	5/-	6⅜—6¾	...	...	6½	Oct. 8	8 14 6	Mar., Aug.	8½	6¾
5,000	10	Do. do. do. 5% Cum. Pref.	5%	5%	6⅜—6⅝	...	...	6 17/32	July 8	7 11 0	Feb., Aug.	8⅝	6¾
77,893	5	Para Elec. Rly. and Ltg. Co., Ord.	5/-	5/-	7¼—7¾	+ ⅛	...	7 1/16	Dec. 30	6 9 0	May, Nov.	8	6
100,000	1	Perth (W.A.) Electric Tramways Ord.	6d.	7½d.	1 3/32—1 11/32	+ 3/32	...	25/6	Nov. 8	4 2 0	*Sept.*, Nov.	26/3	¾
245,000	1	Potteries Electric Traction Ord.	7/8	for '11	5/16—7/16	+ 1/16	...	7/6	Dec. 2	8 0 0	April.	¾	⅛
245,000	1	Do. do. 5% Cum. Pref.	6d.	5d.	13/32—15/32	...	...	12/9	Dec. 2	6 19 0	*Feb.*, Aug.	¾	7/16
124,560	1	Provincial Tramways Ord.	8d.	10d.	11/16—13/16	+ 1/32	...	14/-	Dec. 31	9 4 9	May. *Nov.*	1 5/16	21/32
10,000	10	Do. do. 6% Cum. Pref.	6/-	6/-	9—9½xd	...	...	9⅛	June 19	6 6 6	June, *Dec.*	11	9
50,000	5	Rangoon Elec. Trys. & Supply Co. 6% Cum. Pref.	3/-	3/-	5¾—5⅞xd	...	...	5 13/32	Aug. 31	5 2 3	June, Dec.	6	5
250,000	$100	Rio de Janerio Tramways Light and Power Co.	$2½	$2½	...	...	...	155½	Nov. 7	...	Nv.Fb.*My*.Ag.	165	44¼
100,000	$100	Sao Paulo Tramway, Light, and Power Co.	$5	$5	...	...	...	280	Sept. 30	...	Ja.*Ap*.Jul.Oc.	290	110
32,000	10	Shanghai Elec. Construction Co.	...	...	7¼—8¼	+ ¼	...	8	Nov. 28	...	May.	11½	6
330,400£	Stk.	Singapore Elec. Trys. Ltd., 5% Debs. Red.	5%	5%	82—85	...	...	83½	Dec. 9	5 17 9	Mar., Sept.	88	61
169,570	1	S. Metrop'n Elec. Trys. & Ltg. Co. 6% Cum. Pref.	1/2⅜	May, '12	11/16—13/16	...	...	15/9	May 16	7 7 9	Feb., Aug.	1⅛	¾
91,720£	Stk.	Southern Elec. Trys. of B.A., 1st Mt. Deb.	5%	5%	95—97	...	...	97	Dec. 18	5 5 3	Feb., Aug.	100	90
160,000£	100	Sunderland District Elec. Trys. 5% 1st Mt. Debs.	5%	5%	...	...	...	58¾	June 1/10	...	Jan., July.	88	58⅛
471,500£	100	Toronto Rly. Co. 1st Mt. 4½% Stg. Bonds	4½%	4½%	97—99	...	...	99	Nov. 8	4 11 3	Feb., Aug.	104	97
80,000	5	United Elec. Tramways of Monte Video, Ord.	3/-	4/-	5½—6	...	...	5 9/16	Dec. 27	5 16 9	*June*, Dec.	6½	5
90,000	5	Do. do., do. 6% Cum. Pref.	3/-	3/-	4⅞—5⅜xd	...	...	98/9	Dec. 14	5 11 9	June, Dec.	6⅛	4⅞
500,000£	Stk.	Winnipeg Elec. Rly. Co. 4½% Perp. Cons. Debs.	4½%	4½%	99—102	...	— 1	101½	Dec. 17	4 9 0	Apr., Oct.	109½	100
40,977	5	Yorkshire (West Riding) Elec. Trys. Ord.	...	...	⅛—¾	...	...	8/6	Oct. 31	...	*Mar.*	1½	¼
46,261	5	Do. do. do. 6% Cum. Pref.	3/-	1/6	¾—3½xd	...	...	63/9	Dec. 20	6 8 9	*Mar.*	3¾	1¾

ELECTRIC RAILWAY SHARES.

1,854,720£	Stk.	Central London Ord. Stock	3	3	82—84	+ 2	...	84	Dec. 31	3 11 6	*Feb.*, Aug.	89½	60
572,640£	Stk.	Do 4% Pref. Stock	4	4	83—85	+ 3	...	84¾	Dec. 24	4 15 3	Feb., Aug.	92	80
572,640£	Stk.	Do. Deferred Stock	2%	for '11	82—84	+ 2	...	83	Dec. 31	2 7 9	Feb., Aug.	91⅝	42
1,480,000£	Stk.	City and South London Cons. Ord. Stock	1½	1¼	36—37	...	— 1½	35¼	Dec. 23	3 14 6	*Feb.*, Aug.	46	26¼
78,000	10	Great Northern and City Pref. Ord. 4%	Nil	Nil	2½—2¾	...	...	51/3	Dec. 11	...	*Feb.*, Aug.	2⅞	⅛
50,000	10	Liverpool Overhead Ord.	2/-	2/-	3¾—3⅞	+ ⅛	...	65/-	Oct. 31	5 3 3	*Feb.*, Aug.	4	⅝
1,412,263£	Stk.	Mersey Cons. Ord. Stock	Nil	5⅜	5¼—5½	...	— ½	85 -	Dec. 31	...	*Feb.*, Aug.	8	1
5,732,062£	Stk.	Metropolitan Cons.	1¾	1½	53—53½	...	— 3¼	50 5/16	Dec. 31	3 0 9	*Feb.*, Aug.	75⅛	34
2,640,914£	Stk.	Do. Surplus Lands Stock	2¾	2¾	62—64	...	...	63	Dec. 20	4 6 0	*Feb.*, Aug.	72	62
3,235,000£	Stk.	Metropolitan District Ord.	Nil	Nil	40½—41	...	— 1	40½	Dec. 31	...	*Feb.*, Aug.	51½	9½
467,000	10	Underground Electric Railways Co. of London	...	...	4⅜—4⅝	...	...	91/3	Dec. 31	...	...	4⅞	1⅜
1,730,000£	...	Do. 4½% Bonds of 1933	4½%	4½%	100—102	...	...	101 5/16	Dec. 31	4 10 0	Jan., July	102	73
1,192,707£	...	Do. 6% 1st Income Debs.	...	...	111—113	...	— 1	112¾	Dec. 30	5 6 3	...	117½	110½
6,120,750£	...	Do. 6% Income Bonds	20/-	40/-	92½—93½	+ 1½	...	93⅛	Dec. 31	3 4 3	Mar., Sept.	93⅝	18

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Oxford and Petrol-Electric Tramcars.—In their report for 1912, the directors of Oxford Tramways Company state that a dividend of 2 per cent. was paid in January, 1912. The City of Oxford Electric Tramways, Limited, have not made any payment to the Syndicate on account of the profits for 1912, and the directors are, therefore, unable to declare a further dividend at present. Under the Oxford and District Tramways Act, 1909, the City of Oxford Electric Tramways, Limited, are liable for certain weekly penalties for not completing the electrification before August last, and the National Electric Construction Company, under an agreement with the Corporation, are guarantors thereof. The time for electrification, under the Act of Parliament, expires in August, 1914, and it is hoped before then the City of Oxford Electric Tramways, Limited, and the Corporation of Oxford will be able to agree upon a system of traction. The system of tramways authorised by the 1909 Act of Parliament was a combined system of conduit and overhead. The National Electric Construction Company are now investigating a scheme of petrol-electric cars.

Tramways, Light, and Power, Limited.—The subscription list closed on December 12 for 300,000 six per cent. cumulative preference shares of £1 each in this company, the authorised capital being £600,000. The company has been formed to take over the undertakings of the Nottinghamshire and Derbyshire Tramways Company, Derbyshire and Nottinghamshire Electric Power Company, Leamington and Warwick Electrical Company, Limited, and Leicestershire and Warwickshire Electric Power Company; and to carry on the business of contractors for the construction and equipment of tramways and railways with electric or other mechanical power, owners of tramways, light railways and electric lighting and other works, etc. Mr. W. C. C. Hawtayne, consulting engineer, estimates that the annual net earnings should amount to £46,500, leaving a surplus of £21,000, after payment of debenture interest and a 6 per cent. dividend on the preference shares. The directors are Viscount Chilston (director of the South Eastern and Chatham Railway), Mr. A. R. Holland (chairman of Mansfield and District Tramways), and Mr. Geo. Balfour, M.I.E.E. The secretary is Mr. Wm. C. Bryden, 22a, College Hill, London, E.C. The operating management of the properties will be in the hands of Balfour, Beatty, and Company.

Partial Introduction of Halfpenny Fares at Bradford.—The city treasurer has submitted to the Tramways Committee the financial statement for the half-year ended September 30, showing a profit of £25,997, as compared with £35,867 for the corresponding period of last year. The decrease of £9,870 is chiefly accounted for by the increased expenditure on repairs to permanent way, cars, and other rolling stock, power, and wages, and also by the introduction of halfpenny fares up to 9 a.m. The decrease on account of this latter item, however, is by no means so considerable as the general manager (Mr. C. J. Spencer) originally estimated it would amount to. The traffic income has been £143,358, which is less than the corresponding half of the previous year by £993, notwithstanding the increased car-mileage run of 127,000. It is pointed out that if the same rate of earning per car-mile had been maintained as last year (11·913 pence), the income would have been some £6,000 more. Repairs for the permanent way show an increase of £2,109, and cars and other rolling stock an increase of £2,008. Power expenses have increased to £992, accounted for by the increased mileage run. Traffic expenses, including the wages of motormen, conductors, etc., have been £36,624, as compared with £34,480 last year. With regard to the railless route, this part of the undertaking shows a loss for the half-year of £181, the expenses being £798, as compared with an income of £617. The income for the carriage of parcels was £4,242, and the expenses £3,926.

British Columbia Electric Railway.—Mr. R. M. Horne-Payne, in moving the adoption of the report, at the seventeenth ordinary general meeting held in London on December 11, stated that in February the first hydro-electric unit at Jordan River was put into operation, and it had delivered power into the city of Victoria ever since. The second unit was completed successfully about a fortnight ago, and they had commenced the work of increasing the water storage capacity, so that they might be able gradually to increase the electrical development unit by unit to its ultimate capacity of about 45,000 H.P. Thus they were providing in advance for the increasing demand for power in Victoria and the surrounding districts, where it seemed probable that trade of all sorts, and the company's business, would increase rapidly. The completion of this great hydro-electric development at Lake Coquitlam and Lake Buntzen was now well within sight. It would not only be one of the greatest developments in the world, but also one of the most satisfactory from the standpoint of producing cheap power, and of requiring comparatively little expense for upkeep and maintenance. In addition, the company had constructed new lines of railway in many directions, and had carried out improvements on the old lines to meet the demands of traffic, and had greatly extended their light and power system. The various dividends, making total dividends for the year of 6 per cent. on the preferred ordinary stock, and 8 per cent. on the deferred ordinary stock, were approved. It was resolved to increase the capital to £4,600,000 by the creation of 600,000 new shares of £1 each.

EXTENDED HALFPENNY STAGES IN GLASGOW.

EFFECT ON PASSENGERS AND REVENUE.

The doubling of the length of the halfpenny stages on Glasgow tramways came into operation on December 10, 1911, and Mr. James Dalrymple, general manager, has issued a comparative statement showing the results in number of passengers and traffic receipts for the 12 months ended December 9 last, as compared with the 12 months ended December 9, 1911. It will be seen from the appended tables that, despite the increased passenger traffic, the receipts show a decrease of £8,897, the total for 1912 being £975,099, compared with £983,996 for 1911. The following is the statement:

YEAR ENDING DECEMBER 9, 1911.

Fare.	Passengers.	Per cent.	Receipts.	Per cent.
			£ s. d.	
½d.	70,838,231	28·00	147,579 12 11	15·00
1st 2-stage	14,635,987	5·78	91,474 18 5	9·30
2nd 2 stage	14,399,971	5·69	—	—
1d.	121,848,175	48·15	507,700 14 7	51·60
1½d.	20,205,692	7·99	126,285 11 6	12·83
2d.	6,093,051	2·41	50,775 8 6	5·16
2½d.	2,563,528	1·01	26,703 8 4	2·71
3d. and over	2,455,889	·97	33,476 19 4	3·40
	253,040,524	100·00	£983,996 13 7	100·00

YEAR ENDING DECEMBER 9, 1912.

Fare.	Passengers.	Per cent.	Receipts.	Per cent.
			£ s. d.	
½d.	179,037,009	60·23	372,993 15 4	38·20
2nd 2-stage	57,595	·02	—	—
1d.	86,563,757	29·12	360,682 6 5	37·00
1½d.	19,082,243	6·72	124,886 0 5	12·80
2d.	6,183,834	2·08	51,531 19 0	5·30
2½d.	2,784,864	·94	29,009 0 0	3·00
3d. and over	2,637,084	·89	35,993 7 11	3·70
	297,246,386	100·00	£975,099 9 1	100·00

LONDON TRAMWAYS POWER STATION.

PROPOSED SUBSTITUTION OF TURBINES FOR RECIPROCATING ENGINES.

The Highways Committee of the London County Council, at a meeting of the Council on December 10, reported that they had considered the question of enlarging the capacity of the plant at Greenwich generating station to cope with the rapidly increasing load consequent on the extension of tramways. The committee had conferred with the Admiralty on the matter in relation to the work carried out at Greenwich Observatory. As a result an arrangement had been come to on the definite understanding that no further extension of the station was contemplated beyond that outlined in this report. The existing machinery consisted of four 3,500-KW. reciprocating engines, and four 5,000-KW. turbines, or a normal plant capacity of 34,000 KW. The scheme the committee now proposed was that a steam turbine of 8,000 KW. should be substituted for each of the four reciprocating engines. The new normal capacity of the station would then be 52,000 KW. It was proposed to carry out the work in two stages, the first of which must be taken in hand immediately. The second stage would not be carried out unless and until the power requirements necessitated. The first stage would consist of the provision of an overhead crane in the engine-room, the dismantling of two of the reciprocating engines and the substitution therefor of two 8,000-KW. turbines. The size of the switch gear would have to be increased and two motor generators with transformers and switch gear substituted for two small Belliss auxiliary generators, while larger bunkers would have to be provided. It would also be necessary to provide additional condensing water pipes. The cost of the whole of the work of this first stage was estimated at £128,000. The cost of the second stage was put at £99,000.

The provision of the machinery would effect a very considerable economy in working, but the exact saving would depend largely on the price of coal, as this item represented from 75 to 85 per cent. of the total generating costs. The committee were advised that on the completion of the first stage the estimated annual saving on the present maximum output would be £11,430 with coal at 11s. a ton, £13,350 with coal at 13s. a ton, and £15,910 with coal at 16s. a ton. This estimated saving represented a return of from 8 per cent. to 12 per cent. on the new capital expenditure, and at the same time the station would have a clear gain in normal capacity of 9,000 KW., or sufficient to provide for the requirements of the next few years.

The reciprocating engines with their condensers, etc., cost originally about £119,000, but a considerable portion of this sum had been extinguished by the sinking fund. The committee were advised that by the time the plant on the first stage was entirely discarded its book value would be reduced to £43,000, and that if the plant included in the second stage was discarded within a period of six years the book

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value of that plant would be reduced to £32,000, making a total of £75,000. The financial effect of the first stage of the scheme so far as capital charges were concerned showed a net debt charge of £7,220, decreasing by about £100 a year, and against that must be set the estimated annual saving of coal (from £11,430 to £15,910). If the second part of the scheme was carried out, and assuming that it was completed in the year 1919-20, the net debt charge would be £11,865, decreasing by about £170 a year. The committee recommended approval of the scheme, and that tenders be invited for the purchase from the Council of two of the reciprocating engines.

The Finance Committee, reporting on the subject, stated that the scheme appeared to be an economical method of increasing the capacity of the station, and they therefore concurred in the proposal. Specific recommendations for the substitution would have to be approved by the Council before any definite action was taken. The committee were satisfied that a case had been made out for the immediate substitution of two 8,000-KW. turbines.

The report was adopted at a subsequent meeting.

NEW CONTRACTS AND ORDERS.

G. and J. Weir have an order from Rawtenstall Council for a boiler feed pump for the electricity works.

Gravesend Council have accepted a tender by the Lancashire Dynamo and Motor Company to supply a booster at £270.

Hull Council have placed a contract with Mr. Kettlewell, builder, Hull, at £5,095, for extensions and alterations to the power-station.

Salford Council have given a contract to Naylor Brothers for the supply and delivery of bracket arms for 100 tramway standards, at £110.

Dover Tramways Committee have accepted the tender of a local co-operative society for the supply of uniforms for the employees, at £136 10s.

Prahran and Malvern Tramway Trust have accepted the tender of Duncan and Fraser, Adelaide, for the construction of 11 bogie cars, at £775 each.

Musgrave and Company, Limited, have received a contract to supply induced draught plant for new boilers to the West Bromwich Electricity Committee.

The Bell Punch and Printing Company have received an order from Colchester Council for the supply of punches and tickets for a period of three years.

Carlisle Tramways.—The whole of the electrical equipments for the new cars of the Carlisle Tramways were supplied by the British Thomson-Houston Company.

Messrs. Venner and Company, of 6, Old Queen Street, Westminster, have received an order for equipping the Rhondda tramways with Chamberlain and Hookham meters.

Messrs. Clay and Atkinson, of Bradford, have secured the contract for the supply of phosphor bronze, gun-metal castings, and drivers' alarm bells for the Bradford City Tramways for the year 1913.

A Compliment to Balfour, Beatty, and Company.—Luton Council have asked Balfour, Beatty, and Company, Limited, to take a further 10 years' lease of the electric tramway system from February 21 next.

Hall and Company, of Dobb's Fold Works, Wigan, have received orders for "Fibron" axle box packing from the London United Tramways Company, and the Blackpool, St. Anne's, and Lytham Tramways Company.

Chamberlain and Hookham, Limited, have received an order from the Dublin United Tramways Company for 50 car meters. The firm have also received an order from Manchester tramways for 150 car meters, this being the third repeat order.

Blackpool Tramways Committee, on December 19, received tenders for the supply of a motor repair tower, the amounts ranging from £595 to £920. A sub-committee, along with the general manager, Mr. Furness, was appointed to make the selection.

Glasgow Corporation have given contracts as appended: Chip dryers, Municipal Appliances Company; lead-covered cables, National Conduit and Cable Company, Limited, and Western Electric Company, Limited; nidged setts, M'Creath, Taylor, and Company.

Lowestoft Council have allotted tenders as follow: Estler Brothers tramway trolley wheels; British Thomson-Houston Company, three sets of resistances for tramcars; J. W. Brooke and Company, brake blocks, at £6 12s. 6d. per ton, and metal castings at 1s. per lb.

W. Griffiths and Company, London, have received a contract, at £6,225, for the construction of tramway extensions through Castle Street, across Quay Parade to Harbour Road, from Oxford Street to St. Helen's Road, and the paving of Oystermouth Road, Swansea.

A Great Steam Turbine.—The German engineering papers report that Brown, Boveri, and Company have received an order for the largest steam turbine yet built in Europe. It is to be 40,000 H.P., and is for the Communal Electricitätswerke A. G., Hagen, Westfalia.

Dublin Council have accepted the tender of the Mashchinenfabrik Oerlikon for a 3,000-KW. turbo-generator, condensing plant, and accessories, at £11,351. The Electricity Committee reported that the plant installed by the company last year had worked in an extremely satisfactory manner.

Ayr Council have accepted the tender of Walter Scott, Limited, for Sandberg rails, at the price of £1,930 15s. plus 5s. per ton payable to the patentee, for the extension of the tramways to Hawkhill. Callender's Cable and Construction Company's tender for £2,048 13s. has been accepted for the cables.

Sheffield Council have placed the following contracts: Two water-tube boilers, together with chain grate stokers, superheaters, etc., Stirling Boiler Company, £7,790; 14 panels of extra high-tension three-phase switch gear, A. Reyrolle and Company, Limited, at £1,682, in addition to an earlier similar order at the same price.

The British Mannesmann Steel Tube Company have received a contract from Doncaster Council for poles required for the overhead equipment for the tramway extension to Bentley. Application is to be made for sanction to borrow £5,000 in respect of the extensions of the electric cables to Balby and Hexthorpe, and £3,000 for Bentley.

Meters for London County Council Cars.—Messrs. Chamberlain and Hookham, Limited, have received an order through the British Westinghouse Company, for car meters for the Woolwich section of the London County Council Tramways. As these meters are used on the conduit system, a special design has been employed, so that the meters always read forward on the counter, in whichever direction the current is passing through them.

Southend-on-Sea Council have accepted the following tenders: North Eastern Steel Company, Limited, rails, fish plates, etc., for tramway extensions to Southchurch, £1,656; E. Green and Sons, Limited, economiser and air heater, £915; Worthington Pump Company, Limited, five centrifugal pumps, three steam engines, and electric motor, £1,071; Expanded Metal Company, Limited, expanded metal, £35; British Thomson-Houston Company, Limited, switchboard for new steam generator, £96.

London County Council have accepted tenders by the Morgan Crucible Company to supply and fit copper flexibles to carbon motor brushes at an estimated cost of £250, and by Buck and Hickman to supply two dynamometers for testing car motors at the central car repair depot, £527 15s. They have also accepted, after discussion, tenders by Cammell Laird and Company for 6,000 driving wheel steel tyres at £1 4s. each, and by J. Batt and Company for 5,000 pony wheel steel tyres (of German make) at 18s. 10d. each.

Barrow Council have allotted contracts as subjoined in connection with extensions of the electricity works: Steam turbine and three-phase alternator, James Howden and Company, Limited, £3,237; rotary converters with exciters and transformers, British Westinghouse Company, Limited, £2,818; high and low-tension switchboards, British Thomson-Houston Company, Limited, £3,322; condenser and pumps, Willans and Robinson, £1,142; steam and exhaust pipes, valves, etc., weigh tank and recorder, E. Le Bas and Company, £1,239; water-tube boiler, Babcock and Wilcox, Limited, £1,027; coal conveyor, weighing machine, E. Bennis and Company, Limited, £744.

Mr. W. Dobson, of Edinburgh, has been awarded the contract for the construction of a tramways track in Bishopthorpe Road, York, at the sum of £15,147, subject to his compliance with the specification in regard to the use of Sandberg rails, and to the materials being ready before March 3 next, on which date the laying of the track is to commence and be completed by May 31. Consideration of the tenders for the overhead work and mains has been deferred in order that the electrical engineer might report upon the cost of his department undertaking the work. Subsequently he reported that he could carry out the work at a saving of £353, and the order was given to the department.

Walsall Council have placed contracts for tramway supplies as appended: Anti-Attrition Metal Company, trolley wheels; British Insulated and Helsby Cables, mechanical ears, section insulators; British Thomson-Houston Company, controller fingers; British Hele-Shaw Patent Clutch Company, pinion wheels; J. W. Caparn, malleable iron castings; Edison and Swan United Electric Light Company, "O.K." dry cells; Electric and Ordnance Accessories Company, arc lamp globes, S.E. opal and arc lamp carbons; Fleming, Birkby, and Goodall, strand wire; Le Carbone, "S.S." carbon brushes; National Rail and Tramway Appliances Company, brake blocks; Siemens Brothers and Company, tantalum lamps; Brownhills Chemical Works Company, lubricating oil, pitch, and creosote oil; A. Goldie Engholm, P. and B. and Blackley tape; J. Gilbert and Son, best solder; J. North Hardy and Son, linen frame tape and linen tape; Pinchin, Johnson, and Company, air drying voltalac.

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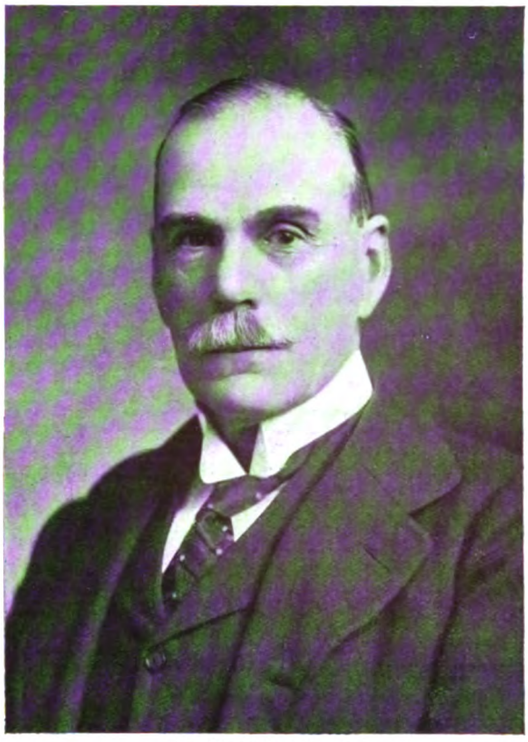
ONE OF THE NEW YEAR KNIGHTS.

The name of Lieut-Col. H. A. Yorke, C.B., appeared in the New Year list of honours as the recipient of a knighthood. He has been the chief inspecting officer of railways under the Board of Trade since 1900, and is a retired officer of the Royal Engineers. He was born in 1848. He served in the Afghan War of 1879-80 and the Nile Expedition



Sir Horatio Yorke.

of 1884-5, and was mentioned in despatches. His admirable and exhaustive reports on railway accidents have contributed greatly to the safety of the travelling public. He has also reported on American railways and on the Paris Metropolitan. The first-mentioned report strongly recommended automatic signalling for underground railways. To tramway authorities Sir Horatio Yorke is well known. He gave evidence concerning the tramway side of the London street traffic inquiry before the House of Commons Committee on January 2. A report of the proceedings will be found on page 50 of this issue.

PERSONAL.

Mr. J. B. Hamilton has been retained to advise the Ramsbottom Urban Council in carrying out the railless trolley traction scheme.

Mr. J. E. Starkie, borough electrical engineer, Burnley, has been recommended by the Electricity Committee for an increase of £100 per annum in his salary.

Mr. J. H. Cardew, electrical inspector to the Government in Madras, has been appointed electrical engineer on the Oudh and Rohilkhund Railway.

Mr. W. Travis, late of the Singapore Tramways, has been appointed chief assistant electrical engineer to Hastings Corporation electricity department.

Mr. C. Hors, consulting electrical engineer, has been commissioned by the West Australian Government to prepare a report on the Perth tramways, which have been purchased by the State.

Mr. H. C. Appleby, senior shift engineer, Kidderminster and District Electric Lighting and Traction Company, has been appointed shift engineer at Rawtenstall Corporation electricity works.

Mr. Fairbairn has been appointed superintendent of the Valley Road electricity works of Bradford Corporation, in succession to Mr. W. Jones, who has retired after 23 years' service in the department.

Mr. W. Calder, city surveyor of Prahran, has been appointed honorary co-examiner in roads, streets, and tramways engineering at Melbourne University, and will act in conjunction with Prof. Payne and Mr. George Higgins.

Mr. E. W. Sleight, of the Dumbarton Burgh and County Tramways Company, Limited, was presented with a gold watch by the staff and employees of the company on the occasion of his leaving to take up the management of the City of Carlisle Tramways.

Mr. W. Binns has been presented with a silver salver and silver tea tray by the Reading borough officials, and a set of gold cuff links and studs by the employees of the tramways department, on resigning his appointment as tramways engineer and manager to take up a position in Brazil.

Mr. S. T. Quilliam, who has been manager of the British office of the Forest City Electric Company during the last seven years, has taken over the rail bond manufacturing business carried on by that company, aud will continue the business as the Forest City Electric Services Supply Company, at Clegg's Court, Chapel Street, Salford.

Sir Joseph Baxter Ellis is to be made an honorary freeman of Newcastle-on-Tyne in recognition of his 32 years' service to the city. Sir Joseph, who was the first Lord Mayor in 1906, was for several years chairman of the Tramways Committee, and he has two sons holding prominent positions in electrical engineering and tramway work.

Mr. J. Walker, who has joined the board and staff of Boving and Company, Limited, water power engineers, was for the last nine years with J. G. White and Company, acting as construction superintendent on works abroad and at home, and latterly as engineer in charge of construction in the head office in London. Prior to this engagement he was for many years with S. Pearson and Son.

Messrs. A. Bell and J. Turney have been re-elected directors of Lancaster and District Tramways Company, and thanked for the services which they have rendered without payment. Mr. Bell, who is chairman of the board, stated that the directors had been given new heart by the possibility of greater success being achieved by the substitution of mechanical for horse traction. Mr. Turney observed that he had made up his mind to retire, but it would now be interesting to take part in the new departure.

Mr. J. W. Hame, general manager and electrical engineer, York Corporation electricity and tramways department, was paid a high compliment by Alderman Meyer, chairman of the committee, in the course of a debate at a meeting of the Council on a proposal to purchase premises for new offices at a cost of £4,000. An amendment not to entertain the purchase was carried by 21 votes to 15. Alderman Meyer, before the vote was taken, stated that the amendment was dead against the responsible advice of the manager, who came to them when the undertaking was in a parlous state. By the manager's exertions it had been pulled round, and was now in a promising condition.

Mr. P. Priestly was referred to as the respected engineer and manager of Mexborough and Swinton Tramways Company by Alderman Winter, J.P., the local director, who presided at the employees' dinner, and he also congratulated Mr. Priestly upon his recovery from illness. Mr. Priestly thanked Alderman Winter for his kindly reference, commended to the men his new assistant engineer, Mr. H. C. Shepherd, and trusted they would look to him as their friend, even as they looked to himself. The company present at the dinner included Mr. C. Jagger, traffic superintendent, Rotherham Tramways; Mr. M. McLeod (traffic superintendent), and Inspectors A. G. Long and H. Smith, Mexborough Tramways.

Mr. C. Mittelhausen, electrical engineer and tramways manager to Bexley Council, has resigned those positions after nine years' service. The Council have accepted the resignation with regret, and granted a testimonial under their seal. The chairman (Councillor Sheldon) observed that Mr. Mittelhausen found the tramways in a very unsatisfactory condition, but now the undertaking was in a satisfactory condition. Councillor Reid, speaking as a member of the same profession, testified to the high esteem in which Mr. Mittelhausen was held among his professional fellow-workers. Councillor Baker-Beall mentioned that that year, after paying interest on loans and instalments of loans, there was a net profit of £840. It was decided to advertise for a successor, at a salary of £300, an amendment to reduce the amount to £250, consequent upon "the dark cloud of motor 'bus competition in front of the Council," being defeated. Mr. H. P. Stokes, Ilkeston tramways manager and engineer, was appointed to the vacancy.

Mr. G. S. Duncan, consulting engineer to the Melbourne Tramways and Omnibus Company, is now in England on business connected with that company's undertakings and other important matters. Mr. Duncan designed and supervised the construction of the cable tramways in Melbourne, some 25 years ago, with such success that the undertaking has been one of the most profitable tramways in the world. Most of the power-station equipment, including many of the present engines and boilers, were built in Melbourne to Mr. Duncan's specifications. Although the cost of materials and labour are, of course, much higher in Melbourne than in this country, the total working expenses of the company amount only to 7·65d. per car-mile, while the ratio of working costs to receipts averages about 54 to 55 per cent. Mr. Duncan, who was born in Scotland, went out to Melbourne to construct the cable tramways, and he has since been busily occupied in various large engineering and mining enterprises in Australia. He has, however, found time to travel much, both in Europe and America. He is not only an engineer of wide experience, but a chemist whose researches are of very great interest and promise.

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TRAMWAY AND LIGHT RAILWAY NOTES.

BIRMINGHAM.—A small poll of the ratepayers having resulted in the rejection of the general powers bill owing to a clause which proposed to allow Sunday boating and bands in two parks, Councillor Barrow, the chairman of the Tramways Committee, hopes that a method will be found for overcoming the consequent dropping of the clause which sought permission for the running of trailer cars on the tramways. Parliament having sanctioned the use of trailer cars in London, the Board of Trade, he has reason to believe, will sanction trailers on the Birmingham tramways. The Tramways Committee have decided to allow six passengers to stand in the lower saloon of each car during rush hours and on wet days.

BLACKPOOL.—The Tramways Committee have decided to order six more cars of the toast-rack type, this bringing the number of open cars to 18. Illustrations of these cars were given in our issue dated October 10, 1912.

BRIGHTON.—Following an experiment in the issue of transfer tickets between various points on several routes and the Central Railway Station, the Council on December 17 agreed to permanently adopt the system.

BRISTOL.—The Traffic Committee recommend the City Council to require the Tramways Committee to remove their tramway posts from the centre of the road from Temple Gate to the top of Blackboy Hill, and to erect posts on the sides of the footways instead, the Corporation to make a contribution towards the cost.

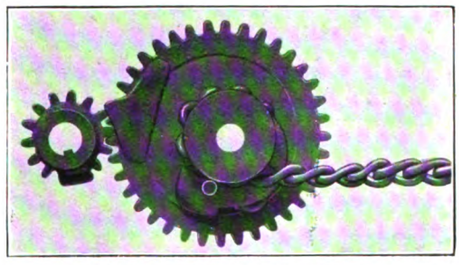
HULL.—The decision of the stipendiary magistrate, in which he dismissed two summonses for alleged offences against the tramways by-laws, and ordered the Corporation to pay 11 guineas costs, has been brought before the Board of Trade by the town clerk, who has asked for the advice of that authority on the question of appealing against the decision. It will be recalled that two passengers were recently summoned for alighting from the driver's end of a tramcar at a terminus, and in this way refusing to obey the Corporation by-law, which states that the passengers shall alight from the rear end, or conductor's platform. The defendants produced the Board of Trade by-law, which is to a similar effect, with the addendum, "except at a terminus." The magistrate held that the Board of Trade by-law over-rode the local one. An appeal has since been lodged.

LEEDS.—The Tramways Committee have reappointed the sub-committee to consider the revision of fares, the mode of collection, and he employment of spare men during busy periods. Those members who were on the old committee visited Glasgow and Sheffield to observe the working of halfpenny fares. The committee are watching the pay-as-you-enter system at Gateshead, which is also to be introduced at Aberdeen and Leicester. Early in January the committee and the manager visited Glasgow.

LONDON.—In reference to a decision by the County Council on July 30 last that the routes on the tramways should be numbered, the routes to be indicated by means of numbers fixed to the cars, the Highways Committee reported, on December 17, that an improved type of plate manufactured by Venner's Signs, Limited, had been brought to their notice. To fit all the cars with this type of plate and the necessary reflector, lamp, etc., would cost about £1,570 more than in the case of the plates originally contemplated. The Council have adopted the plate manufactured by Venner's Signs. In regard to the arrangements for the publication for distribution to the public free of charge of a route map of the tramways, the Council have approved of small tin boxes being fixed in each car to hold copies of the map.—Through running by the cars of the County Council and the Metropolitan Electric Tramways Company has proved so satisfactory between the west end of Euston Road and Enfield that the County Council, on December 17, agreed to an extension of such services to the following routes: Edmonton Town Hall to Holborn; Seven Sisters' Corner and Edmonton to Euston; Finchley to Holborn; Waltham Cross to Smithfield; Muswell Hill to Bloomsbury, and New Southgate to Aldersgate Street. In reply to a question put by Mr. Kingsley Wood, on December 17, Mr. Squires, the chairman of the Highways Committee, stated that the total mileage of new tramways and reconstructed tramways executed by the Council since 1907 was as follows: 1907-8, 13 miles; 1908-9, 13 miles; 1909-10, 29 miles; 1910-11, 10 miles; 1911-12, 6 miles; 1912-13, 4 miles.—On December 20 the new through route between Bloomsbury, Aldgate, and Barking was opened. It is served by the County Council, West Ham, East Ham, and Barking Councils' systems, and embraces the widened East India Dock Road, Poplar. The facilities will be of great convenience to the tramway traffic passing between London and the docks.—The Stoke Newington tramway to the Manor House terminus of the Metropolitan Electric Tramways Company *via* Green Lanes has been opened after electrification. It provides an additional route to the City.

MANCHESTER.—An inquiry is being held by a committee of Manchester Corporation into a scheme for removing the municipal exchange to Piccadilly. Alderman Wilson, chairman of the Buildings Improvements Committee, gave evidence in favour of the proposed site being left open, and its conversion into an arterial centre for

THREE SEPARATE ORDERS FOR



Winding—Note the Stops.

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400
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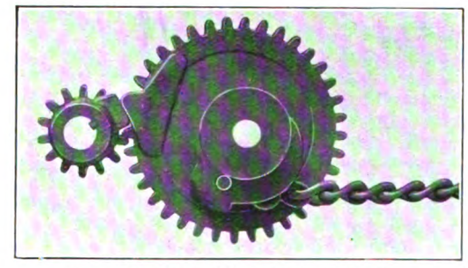

Unwinding—Note the Stops.

"PEACOCK" IMPROVED BRAKES

A TEST ON WHICH YOU SHOULD INSIST.

In some recent trials of geared hand brakes the engineers found that the motormen were in the habit of guessing as to when the brakes were released, and of letting them only partly off, with the result that current was uselessly consumed and brake blocks and tyres were unnecessarily worn. They, therefore, insisted that in each trial the motormen should release the brakes completely before re-applying them, and under these conditions found that on the average the "**Peacock**" **IMPROVED Brake**, by reason of the stops which prevent overrunning of the drum, saved **THREE-QUARTERS** of a turn of the handle.

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tramway traffic. He said that a Special Committee of the Tramways Committee had been sitting for some time, and a report was almost ready, showing the rapid growth of all kinds of traffic on the streets as compared with eight years ago. This problem was a very serious one, and it pointed to the fact that some arterial centre for marshalling tramway traffic would have to be provided. In the interests of the city, the site must remain unbuilt upon on account, firstly, of its central position, and, secondly, its exceedingly low price. More tramway facilities were demanded, and there was also the proposed underground tube system, for which it might be useful. Sir Alexander Porter: Would it not have the effect of putting down a sort of Clapham Junction in the centre of the city? Alderman Wilson replied that it would only be copying Belfast.—A trial is being given on one of the cars running to Ashton of a screen fitted above the dashboard to protect the driver's hands and arms from the wind and rain during inclement weather. The appliance is collapsible, and it can be adjusted to the height of the motorman, covering all but his face, his hands being free for working.

MEXBOROUGH.—Speaking at the annual dinner of the employees of Mexborough and Swinton Tramways Company, Alderman D. L. Winter, J.P., said the Tramways Act, 1870, insisted upon tramway undertakings paving the road between the lines and eighteen inches of either side. In the days of horse-drawn cars one could understand that provision, but it passed his intelligence to conceive why that Act was not repealed long ago, because it could be proved beyond question that no damage was done to the centre of the road by ordinary tramcars or by the use of trolley omnibuses.

OXFORD.—The Tramways Committee granted the Tramways Company to the end of December to propose a workable arrangement in connection with their undertaking to electrify the tramways. It is stated that the company consider there is a prospect of a system of electric accumulators being available at an early date, and that the adoption of the same will be possible for that portion of the city where the company had undertaken to put down the conduit system.

SALFORD.—As the result of a fire at Salford power-station early on December 19 the tramway service had to be suspended for several hours, but the permission to connect the Salford tramways with the Manchester, Bury, and Eccles electrical systems greatly minimised the dislocation. The supply of current for lighting and power was also interfered with. Later in the day the South Lancashire Tramways Company ran their cars to a meeting place on the Salford system. The electrical engineer, Mr. H. J. Hawkins, states that the damage to the works is roughly estimated at £10,000. The outbreak began at the traction switchboard, where an attendant either allowed a spanner to slip, or the man slipped himself with the spanner in his hand, and a short circuit was set up. Sheets of flame flashed across from one switchboard to another, and the current crossed underneath the floor of the room, where there are heavy copper cables, and when once across maintained the arc.

SHEFFIELD.—The Executive Committee of the Sheffield Federated Health Association have passed the following resolution: "With a view to the protection of our suburbs from the growth of new slums, the Executive Committee of the Sheffield Federated Health Association would strongly urge that all districts to which it is decided to extend tramways or motor services should be scheduled under the Town Planning Act before such services are promoted."—Report having been made that passengers carried petrol and similar dangerous substances on the cars, the Sheffield Tramways Committee have directed an order to be issued against the practice.—The tramway employees have disowned the exaggerated statements which have appeared in the Socialist press respecting the men and their conditions. Their delegate on the Trades Council stated that they go straightforward to the manager with any grievances, knowing that they will receive proper consideration. The greatest difficulty the men's secretary has to deal with is that they do not tell him the full facts of the case when he has to ventilate grievances.

SOUTHPORT.—The report prepared by Mr. C. W. Mallins, general manager of the Liverpool tramways, on the outlook for the Southport tramways has been considered by the General Purposes Committee. Mr. Mallins makes a number of recommendations, and he is of opinion that there is nothing in the condition of the undertaking to cause anxiety; that with ordinary maintenance it can be kept up-to-date and continue serviceable for many years. He also thinks it will ultimately become a paying department. One of Mr. Mallins' proposals is to abolish the car service on what is called the inner circle route, so as to save £2,000 per annum, but the General Purposes Committee have decided only to restrict the service. The fares are too low, and recommendations for their revision are under consideration. The committee have decided to increase the wages of the employees by a farthing per hour, and to reduce the hours of labour from 60 to 57 per week.

SWANSEA.—In reference to the estimated financial effect of the development of the Town Hill estate for building purposes, the borough treasurer estimates that at the end of the first 15 years there would be £1,349 per annum to the credit of the Corporation after meeting all charges. Mr. S. Sellon, who had been consulted as to constructing tramways up the hill, was of opinion that there would be no deficit on the tramway. The treasurer considers there would be a deficit on the general scheme of about £1,500 during the first year or two, to meet the charges on the purchase of the land and the laying down of tramways.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

∴ If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS.

Applications for Letters Patent have been filed:

27,022 Means for the regulation and control of railway traffic—H. von Kramer and J. Sayers.
27,069 Regulation of electric installations and systems—Akt. Ges. Brown, Boveri, et Cie.
27,235 Regulating mechanism for electric distribution systems—British Thomson-Houston Company, Limited, E Garton and A. H. St. C. Watson.
27,236 Electric control systems—British Thomson-Houston Company.
27,286 Safety appliances or guards for motor vehicles—H. T. Baker.
27,379 Car journal boxes—A. Berry.
27,407 Automatic brake for preventing railway collisions F. Honig.
27,482 Dynamo-electric brakes for electric motors—Etchells, Congdon and Muir, Limited, and F. Muir.
27,496 Electric welding tool—E. H. Jones.
27,530 Automatic electric circuit-breaking arrangements—E.O. Moller.
27,567 Railway signalling apparatus—H. H. Bosson.
27,624 Control of electric motors—British Thomson-Houston Co.
27,692 Mechanism used to prevent collisions on railways—S. Irons.
27,721 Brakes acting by rolling friction—J. M. Gal.
27,837 Control of electric motors—F. E. Case.
27,874 Electric switches—Siemens Brothers' Dynamo Works, Limited, and R. A. R. Bolton.
27,907 Life-saving guard—E. Carlton.
28,300 Electric lighting systems of railway carriages—Variable Speed Gear, Limited, and J. Robson.
28,342 Brakes for railway vehicles—W. E. Bowers.
28,529 Tram rail—J. Bennett.

GREEN'S ECONOMISER

Utilizes Waste Heat Efficiently.

Increases Steaming Power of Boilers.

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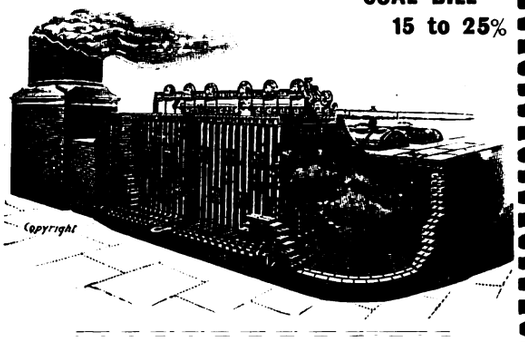

Patentees and Sole Makers—
E. GREEN & SON, LD., Wakefield, Manchester, London, and Glasgow.

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DIRECTORY OF ELECTRIC TRAMWAYS.

A complete Directory of Electr c Tramways in the United Kingdom will be found among the advertisement pages preceding the reading pages of this issue.

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CONDENSING PLANT
— WRITE TO —
THE MIRRLEES WATSON CO., LTD.,
SCOTLAND STREET, GLASGOW.

Key and Property Registry.
FIVE YEARS FOR 1/-
AGENTS WANTED. LIBERAL COMMISSION.
The Property Restoration Company,
17 & 19, Change Alley,
SHEFFIELD.

28,538 Fittings of metallic conduits for electrical conductors—Simplex Conduits, Limited, and L. M. Waterhouse.
28,636 Switches for tramways—R. Cumming.
28,779 Method of transmitting electric current to motors of electrically-propelled vehicles—S. M. Searle and J. H. Wilkins.
28,801 Ear and sleeve for connecting and supporting the adjacent ends of trolley wires—A. T. Birkby and F. E. Birkby.
28,819 Seats for tramway vehicles—G. D. Peters and W. Roberts.
28,916 Street and station indicators—W. Jacobsen, J. D. Cameron, and F. J. Lough.
28,927 Means for cleaning tram-rails—A. McMullan.
28,957 Apparatus for delivering tram tickets—L. D. Brementhal.
28,969 Vacuum brake apparatus for railway vehicles—E. S. Luard.
29,152 Trolley head shield for tramcars—H. E. Wright.
29,186 Rolling stock and rail tracks therefor—C. de Bange.
29,297 Electric transformers—British Thomson-Houston Company.
29,303 Automatic vacuum brakes for railway trains—V. Swanton and F. Godwin.
29,507 Fare box or ticket receptacle—International P-A-Y-E Tramcar Company, Limited, and A. J. Tanner.

SPECIFICATIONS PUBLISHED.

1911.

21,930 Tramway and 'bus ticket holders—Wright.
25,028 Means of applying brakes to tramway cars—Mitchell.
25,364 Overhead systems for transmitting electricity—Paul.
25,377 Couplings for electric mains or wires on railway passenger coaches—J. Stone and Company, and Darker.
26,088 Spring clip for railway or tramway tickets—Williams.
26,570 Self-propelled vehicles or motor wagons—Clayton and Co.
26,863 Control of electric motor generator sets—British Thomson-Houston Company, and David.
23,650 Railway, tramway, and other brakes—Taylor.

1912.

3,479 Continuity of electric conduit systems—Railing and Taylor.
7,440 Railway rail joints—Tieche, Meier, and Russell.
12,004 Steam boilers—Babcock and Wilcox, Limited.
14,823 Railway and tramway points—Meldini.
18,161 Axle-bearings for tramway vehicles—Herbert, and G. and J. Jaeger Ges.
7,831 Axle-boxes for railway and tramway vehicles—Wood.
12,017 Signalling on railway and tramway vehicles—Rowntree.
12,903 Railway track points—Stahlberg.
15,681 Brake lever guard and holding down pin—Bowles.
1,811 Indicating on tramcars their position on the route—Gibson.
6,643 Construction of tramcars—Pilcher.
7,779 Car couplers—Lake (*Munger*).
9,985 Rail-lubricating appliances—Warnecke.

TRAFFIC RETURNS.

TRAMWAYS AND OMNIBUSES.	1911. WEEKS ENDING.					1912. WEEKS ENDING.					AGGREGATE.		
	Dec. 1.	Dec. 8.	Dec. 15.	Dec. 22.	Dec. 29.	Nov. 30.	Dec. 7.	Dec. 14.	Dec. 21.	Dec. 28.	Wks.	1912.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1,315	1,407	1,257	1,435	1,399	1,390	1,355	1,381	1,315	1,488	30	46,116	+ 610
Ayr Corporation	188	186	189	197	203	189	187	199	202	209	32	11,299	+ 289
Bath Electric	649	692	651	729	991	688	639	677	697	903	52	45,453	+ 2,171
Birmingham Corporation	8,494	8,618	8,677	9,727	9,010	11,088	11,278	11,589	11,987	12,520	39	422,276	+123,961
Blackburn Corporation	1,008	1,000	1,015	1,042	1,390	1,109	1,047	1,120	1,100	1,366	39	47,121	+ 1,129
Blackpool and Fleetwood	260	220	215	236	397	245	237	235	251	334	26	25,342	- 527
Blackpool Corporation	435	425	403	426	660	438	500	438	440	600	39	64,170	+ 5,884
Bolton Corporation	2,412	2,346	2,452	2,573	2,628	2,430	2,465	2,539	2,567	2,781	39	100,967	- 85
Bournemouth Corporation ...	1,425	1,412	1,529	1,768	1,711	1,390	1,453	1,549	1,695	1,783	39½	74,756	+ 2,158
Bradford Corporation	4,984	4,960	5,101	5,652	5,657	5,035	5,083	5,486	5,784	6,130	39	218,074	+ 1,622
Brighton Corporation	756	748	776	936	921	751	785	793	856	980	39	41,092	- 962
Bristol	5,738	5,922	5,938	6,610	8,061	6,675	6,431	6,773	7,405	8,845	26	362,120	+ 30,939
British Elec. Trac. Co's. Undertakings													
Airdrie	271	266	262	276	265	305	276	295	291	313	52	15,558	+ 3,614
Barnsley	178	182	181	190	248	202	191	203	206	261	52	9,587	- 107
Barrow	279	302	286	329	323	327	308	327	345	385	52	19,546	+ 3,471
Birmingham and Mid. Joint Com.:													
Birmingham and Midland ...	872	895	890	952	1,170	962	935	973	1,003	1,253	52	50,492	+ 3,371
Dudley-Stourbridge	765	793	836	834	1,053	833	927	836	866	1,144	52	46,687	+ 1,244
South Staffordshire	847	866	964	943	1,292	1,022	970	1,011	1,046	1,486	52	50,370	+ 4,054
Wolverhampton District ...	441	478	459	494	661	501	476	515	509	708	52	25,617	+ 1,061
Devonport	459	474	314	551	559	476	498	311	545	566	52	27,812	+ 1,762
Gateshead	1,020	1,057	1,031	1,136	1,217	1,065	1,039	1,145	1,126	1,305	52	54,865	+ 312
Gravesend and Northfleet ...	195	202	201	243	279	209	196	207	220	307	52	11,091	- 91
Greenock-Port Glasgow	672	710	714	709	730	725	712	731	772	755	52	41,775	+ 4,073
Jarrow	111	119	114	121	130	121	122	190	141	144	52	7,060	+ 288
Kidderminster	87	91	87	97	156	91	94	89	96	130	52	6,114	+ 82
Merthyr...	193	194	201	212	290	196	189	194	198	285	52	10,545	- 402
Metropolitan Electric	8,075	8,132	8,091	8,854	10,135	8,374	8,035	8,629	8,813	10,375	52	456,600	- 56
Middleton	289	298	286	310	366	296	271	286	296	352	52	17,214	- 382
Oldham-Ashton	546	555	550	571	664	583	546	580	590	667	52	31,692	+ 1,730
Peterborough	104	111	108	132	168	115	110	119	122	184	52	7,088	+ 391
Potteries	2,060	2,121	2,075	2,192	2,543	2,187	2,051	2,174	2,193	2,577	52	102,083	- 1,114
Rothesay	38	37	42	37	46	40	40	40	40	45	52	10,699	+ 502
Sheerness	40	43	45	56	47	45	44	47	49	55	52	2,633	- 70
South Metropolitan	670	704	752	777	975	717	704	752	799	1,020	52	43,770	- 645
Southport	228	231	228	251	271	236	236	247	267	279	52	15,421	- 155
Swansea...	1,050	1,060	1,072	1,157	1,440	1,122	1,079	1,142	1,165	1,474	52	60,235	+ 572
Taunton	38	41	44	48	59	43	38	46	46	61	52	2,377	+ 110
Tynemouth	138	140	138	144	160	140	134	257	178	191	52	12,370	- 750
Weston-super-Mare	23	25	24	26	30	24	28	24	25	29	52	6,948	- 1,296
Worcester	235	240	240	283	301	256	232	251	259	331	52	15,209	- 35
Wrexham and District	103	100	96	106	143	110	101	103	110	154	52	6,004	+ 638
Yorks. (Woollen) District ...	979	1,023	985	1,056	1,439	1,039	1,019	1,052	1,085	1,512	52	56,666	+ 1,504

(Continued on page 42.)

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TRAFFIC RETURNS—*continued.*

TRAMWAYS AND OMNIBUSES.	1911. WEEKS ENDING.					1912. WEEKS ENDING.					AGGREGATE.		
	Dec. 1.	Dec. 8.	Dec. 15.	Dec. 22.	Dec. 29.	Nov. 30.	Dec. 7.	Dec. 14.	Dec. 21.	Dec. 28.	Wks.	1912.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Burnley Corporation	1.341	1.302	1.354	1.519	1.576	1.446	1.423	1.553	1.547	1.762	39	59.350	+ 4.682
Burton-on-Trent Corporation ...	253	254	261	346	273	258	255	271	276	323	39	10.699	- 464
Bury Corporation	1.120	1.131	1.146	1.255	1.382	1.158	1.229	1.225	1.244	1.409	43	50.904	- 57
Cardiff Corporation	2.238	2.217	2.350	2.686	2.348	2.331	2.343	2.519	2.577	2.735	39	96.086	- 807
Chatham and District	728	760	757	852	961	812	759	817	847	977	52	44.506	+ 156
Chesterfield Corporation	214	227	219	227	284	231	230	237	238	300	39	8.892	- 66
Colne and Trawden	233	228	222	246	268	231	236	253	244	286	52	13.393	+ 521
Cork Electric	413	454	443	491	510	444	420	449	463	537	52	24.940	- 937
Croydon Corporation	1.524	1.632	1.605	1.845	...	1.636	1.619	1.706	1.720	...	38	68.580	- 549
Darlington Corporation	207	207	213	249	231	227	217	221	236	264	39	8.847	+ 145
Derby Corporation	815	852	822	1.019	949	819	860	878	948	1.060	39	34.878	- 1.200
Dover Corporation	182	186	189	238	204	188	186	189	206	222	39	9.693	- 592
Dublin and Lucan	107	109	105	131	183	102	112	109	116	253	26	3.845	- 28
Dublin United	5.173	5.403	5.259	6.052	5.535	5.317	5.249	5.576	5.812	6.142	26	150.158	- 7.275
Dundee City	1.141	1.092	1.186	1.194	1.479	1.124	1.143	1.186	1.283	1.419	33	40.390	+ 980
East Ham Corporation	1.027	1.061	1.044	1.187	1.156	1.025	1.019	1.051	1.075	1.259	39	42.182	- 866
Exeter Corporation	260	270	304	321	365	269	265	291	295	355	39	12.892	- 778
Glasgow Corporation	19.010	18.871	17.583	18.545	18.742	18.393	18.581	19.317	19.319	20.021	39	569.293	- 6.000
Glossop (Urban Elec. Supply Co.)...	117	115	123	130	136	119	120	128	129	140	52	6.135	- 329
Halifax Corporation	1.657	1.713	1.610	1.746	2.247	1.818	1.707	1.838	1.816	2.160	38½	78.732	+ 1.164
Hastings and District	694	678	694	752	1.040	710	659	684	712	904	52	49.407	- 2.585
Huddersfield Corporation	1.877	1.767	1.849	2.062	2.176	1.953	1.933	2.014	2.077	2.483	41	78.861	+ 2.140
Hull Corporation	2.885	2.974	2.999	3.464	3.265	3.027	3.002	3.100	3.208	3.473	39	116.707	+ 1.625
Ilford U.D. Council	457	343	466	561	559	392	402	417	442	537	39	18.739	- 2.455
Ilkeston Corporation	120	119	123	135	119	109	112	113	121	123	40	4.529	- 781
Ipswich Corporation	325	343	390	438	418	355	346	370	421	473	39	17.628	- 80
Isle of Thanet	244	255	268	304	357	268	263	276	292	356	13	4.273	- 124
Keighley Corporation	123	...	...	...	...	157	...	...	...	...	—	—	—
Kilmarnock Corporation	155	145	150	154	166	147	145	159	155	167	32	5.314	- 150
Lanarkshire	1.451	1.417	1.377	1.384	1.449	1.496	1.425	1.531	1.508	1.566	52	78.676	+ 2.012
Lancashire United	1.217	1.246	1.260	1.236	1.517	1.306	1.238	1.293	1.321	1.509	52	70.096	+ 361
Leeds City	7.048	7.341	7.298	7.926	8.026	7.432	7.499	7.752	8.009	8.758	39	306.005	+ 10.870
Leicester Corporation	2.408	2.520	2.499	2.929	2.782	2.605	2.670	2.674	2.768	3.113	52	133.926	+ 4.652
Leith Corporation...	583	552	577	604	627	600	589	619	611	675	32½	22.091	+ 660
Liverpool Corporation	11.282	11.593	11.957	13.700	12.052	11.851	11.947	12.618	13.208	13.258	52	625.164	+ 26.978
Llandudno and Colwyn Bay ...	103	135	116	134	186	160	101	133	136	207	4	577	+ 6
London County Council	41.316	42.785	41.971	44.985	45.862	41.091	40.069	41.904	42.618	45.036	39	1.622.413	- 80.642
London General Omnibus... ...	37.210	38.151	39.059	41.430	35.401	54.147	55.107	57.308	60.392	52.607	13	719.225	+230.135
London United	5.210	5.456	5.239	6.030	6.345	5.290	5.296	5.540	5.731	6.718	52	322.156	- 13.166
Lowestoft Corporation	150	152	177	200	165	163	154	177	176	187	12	2.246	- 15
Maidstone Corporation	...	140	138	151	202	...	146	157	156	224	39	7.593	+ 308
Manchester Corporation	15.632	15.903	16.127	17.573	16.195	16.368	16.455	17.084	17.765	17.278	39	657.856	+ 23.277
National Steam Car	4.728	...	...	...	5.082	8.373	...	...	...	8.584	9	16.957	+ 7.147
Nelson Corporation	162	163	171	198	206	194	173	194	184	214	39½	7.770	+ 481
Newcastle-on-Tyne Corporation ...	4.236	4.166	4.324	4.820	4.456	4.409	4.519	5.080	4.821	5.055	39	174.241	+ 4.841
Newport (Mon.) Corporation ...	665	652	675	790	726	692	678	751	727	863	39	27.826	- 146
New St. Helens and District ...	626	646	694	671	898	696	664	713	704	846	26	19.607	+ 322
Northampton Corporation... ...	449	474	465	557	650	506	465	492	504	654	38½	21.148	- 36
Nottingham Corporation	2.898	3.047	3.003	3.080	3.324	3.152	3.042	3.182	3.132	3.286	39	123.923	+ 1.666
Oldham Corporation	1.851	1.830	1.906	2.064	2.086	1.838	1.955	1.979	2.045	2.276	40	82.384	+ 4.862
Portsmouth Corporation	1.616	1.658	1.669	1.970	1.721	1.604	1.647	1.755	1.877	1.768	39	84.017	- 4.698
Preston Corporation	691	728	712	756	968	758	740	768	799	927	39	32.413	+ 1.433
Provincial...	1.422	1.451	1.498	1.771	1.714	1.457	1.512	1.602	1.723	1.815	13	20.879	+ 1.037
Reading Corporation	558	580	617	677	789	613	571	648	648	791	38½	25.144	- 259
Rochdale Corporation	1.262	1.283	1.335	1.459	1.557	1.383	1.382	1.451	1.506	1.735	39	60.374	+ 4.972
Rotherham Corporation	645	678	661	708	911	860	818	878	870	1.008	38½	30.223	+ 3.498
Salford Corporation	4.667	4.722	4.789	5.120	5.162	4.681	4.958	5.022	4.181	4.874	39	196.281	+ 3.668
Sheffield Corporation	6.513	6.485	6.666	7.296	7.499	6.798	7.103	7.226	7.242	8.290	39	270.958	+ 12.519
Southampton Corporation... ...	1.029	1.107	1.055	1.211	1.255	1.085	1.048	1.117	1.143	1.251	38	48.321	- 124
Southend-on-Sea Corporation ...	421	452	422	510	519	548	514	535	560	609	38	31.325	+ 3.396
South Shields Corporation ...	566	577	587	661	662	570	582	641	624	752	39	25.017	+ 387
Sunderland Corporation	1.203	1.215	1.249	1.395	1.320	1.193	1.265	1.256	1.363	1.560	39	51.350	- 1.107
Swindon Corporation	134	149	148	161	216	144	134	152	154	192	38½	6.073	- 287
Tyneside Tramways and Tramroads	418	436	420	431	509	445	416	638	552	541	26	12.932	- 208
Wallasey Corporation	942	1.009	985	1.132	1.039	987	967	1.026	1.077	1.077	38	43.611	- 219
Walsall Corporation	556	566	566	663	739	582	585	611	619	849	52	30.402	+ 900
Walthamstow U.D. Council ...	617	617	615	719	785	631	638	664	690	847	39	28.494	- 1.104
Warrington Corporation	381	401	418	437	498	438	431	455	456	523	39	16.844	+ 1.149
West Ham Corporation	2.582	2.630	2.575	2.849	3.008	2.493	2.458	2.558	2.692	3.040	38½	101.904	- 3.997
Wigan Corporation	1.233	1.281	1.318	1.341	1.519	1.354	1.311	1.391	1.438	1.625	38½	52.184	+ 1.999
Wolverhampton Corporation ...	951	938	944	1.267	1.036	976	1.045	1.031	1.129	1.306	40	41.106	+ 1.439
Yorkshire (West Riding)	1.176	1.121	1.168	1.315	1.572	1.191	1.254	1.257	1.340	1.837	52	67.997	+ 1.707
FOREIGN TRAMWAYS.													
Anglo-Argentine	52.569	49.922	52.140	53.175	57.767	54.552	59.056	56.863	57.159	64.790	52	2.708.166	+141.496
Auckland ... ... (28 days)	16.594	...	...	...	...	19.174	...	...	...	...	21	97.203	+ 15.752
Bombay ... ... Rs.	4.079	4.711	...	...	...	3.180	3.290	...	...	...	49	1.49.233	+ 3.394
Brazilian Street ... (month) Mlrs.	38.382	...	...	...	...	44.278	...	...	...	...	17	171.342	- 1.529
Brazilian Traction ... ...(month)	...	...	...	...	...	364.443	...	...	...	...	13	1.075.707	—
Brisbane ... ...(month)	21.890	...	...	...	...	24.310	...	...	...	...	48	228.421	+ 551
British Columbia ... (month) $	488.699	...	...	...	...	591.127	...	...	...	...	22	2.822.812	+544.421
Buenos Aires Port and City (month)	6.004	...	...	...	...	6.034	...	...	...	...	48	67.849	+ 6.106
Buenos Ayres Lacroze ...(month)	41.356	...	...	...	...	44.773	...	...	...	...	22	216.831	+ 29.087
Calcutta ... ... Rs.	59.086	56.720	57.520	61.924	78.056	66.550	65.796	64.890	62.610	66.164	52	32.10.793	+2.16.127
Cape Town ... ...(month)	10.736	...	...	...	...	11.267	...	...	...	...	21	54.593	+ 3.085
Carthagena and Herrerias (month)	1.409	...	...	...	1.888	1.703	...	...	...	3.001	52	26.346	- 1.331
East India ... ...(month)	1.429	...	...	...	...	1.924	...	...	...	...	17	7.688	+ 1.980
Kalgoorlie ... ...(month)	3.165	..	...	...	...	2.861	...	...	...	...	48	34.604	- 3.340
La Plata ... ...(month)	4.446	...	...	...	...	5.210	...	...	...	...	48	46.314	+ 1.923
Lima ... ...(month)	30.297	...	...	...	...	30.700	...	...	...	...	48	339.166	- 2.348
Madras ... ... Rs.	20.653	(2 weeks)	22.730	(2 weeks)	24.709	21.902	(2 weeks)	23.821	(2 weeks)	29.482	52	5.98.083	+ 63.983
Melbourne ... ...(month)	63.500	...	...	...	...	66.000	...	...	...	...	48	612.500	+ 58.500
Mexico ... ... (month) $	521.421	...	...	...	...	565.239	...	...	...	...	48	6.159.944	+548.603
Montevideo ... ...(month)	26.614	...	...	...	...	29.623	...	...	...	...	4	29.623	+ 3.009
Para	3.672	3.747	3.684	3.632	3.631	3.743	4.161	3.910	3.622	4.020	4	15.713	+ 1.019
Perth (W.A.)	1.704	1.740	1.809	2.008	2.421	1.958	2.025	2.131	2.216	2.625	52	98.779	+ 13.877
Port Elizabeth ... ...(month)	2.953	...	...	...	...	3.216	...	...	...	...	21	15.577	+ 1.208
Shanghai ... ... $	17.834	18.419	17.283	19.314	16.816	20.600	20.200	20.200	18.600	19.200	52	1.020.260	+230.116
Singapore ... ... $	9.982	10.409	9.992	9.430	9.192	10.031	10.478	10.435	10.380	10.266	52	541.048	+ 10.697
Toronto ... ... (month) $	676.791	...	...	...	...	742.156	...	...	...	...	48	7.717.303	+828.515
Winnipeg ... ... (month) $	355.825	...	...	...	...	345.091	...	...	...	...	48	3.403.683	-106.165
ELECTRIC RAILWAYS.													
Central London	5.222	5.517	5.440	5.795	3.778	5.889	5.624	5.795	5.969	4.407	26	129.061	+ 4.924
City and South London	3.305	3.702	3.338	3.886	3.808	3.090	3.075	3.204	3.298	3.512	26	77.506	- 6.976
Great Northern and City	1.708	1.716	1.692	1.717	1.589	1.503	1.497	1.482	1.475	1.267	26	36.683	- 1.648
Liverpool Overhead	1.420	1.422	1.544	1.641	1.333	1.545	1.587	1.595	1.628	1.500	26	42.380	+ 3.379
London Electric	14.380	15.080	14.765	15.355	13.355	14.985	14.480	14.890	14.975	13.460	26	344.640	+ 24.178
Mersey	2.145	2.186	2.288	2.606	2.193	2.282	2.351	2.370	2.647	2.491	26	57.014	+ 5.287
Metropolitan	17.966	18.668	18.457	19.326	17.701	18.145	18.340	18.466	18.700	18.402	26	447.583	+ 5.354
Metropolitan District	12.326	12.356	12.506	12.986	11.686	13.767	12.763	13.052	13.112	12.214	26	326.157	+ 24.178

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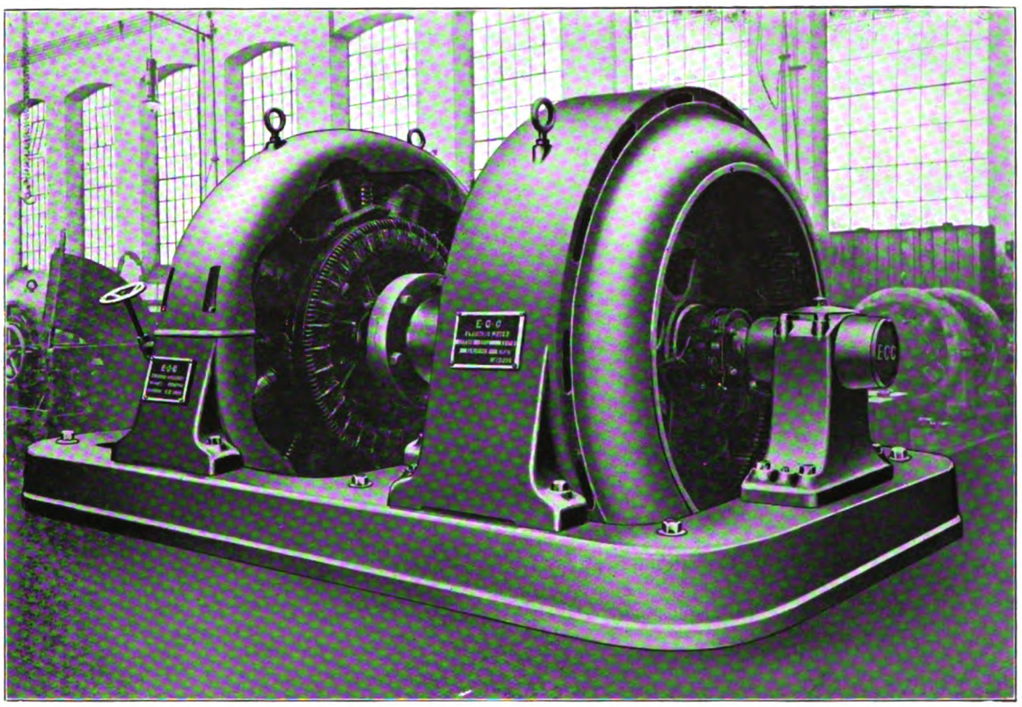
:: :: **E.C.C.** :: ::

ELECTRICAL PLANT
AND
SWITCHGEAR

OF EVERY DESCRIPTION.



600 KW. SYNCHRONOUS MOTOR-GENERATOR.

THE

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TELEGRAMS—"Concordance," London.

ADDRESS—
DASHWOOD HOUSE,
9, NEW BROAD STREET,

LONDON.

WORKS:

TELEPHONES—75 and 430 Wolverhampton.
TELEGRAMS—"Electric," Wolverhampton.

ADDRESS—
BUSHBURY,

WOLVERHAMPTON.

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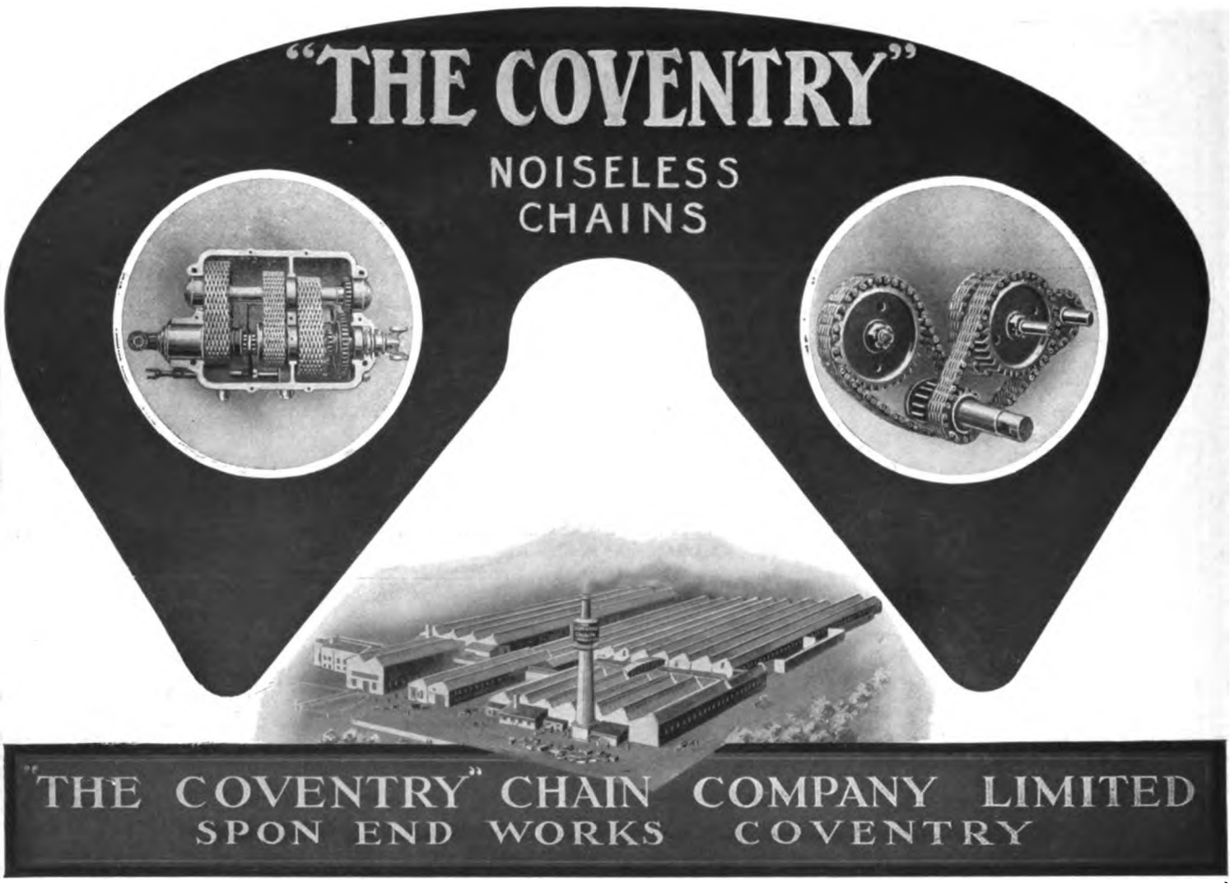

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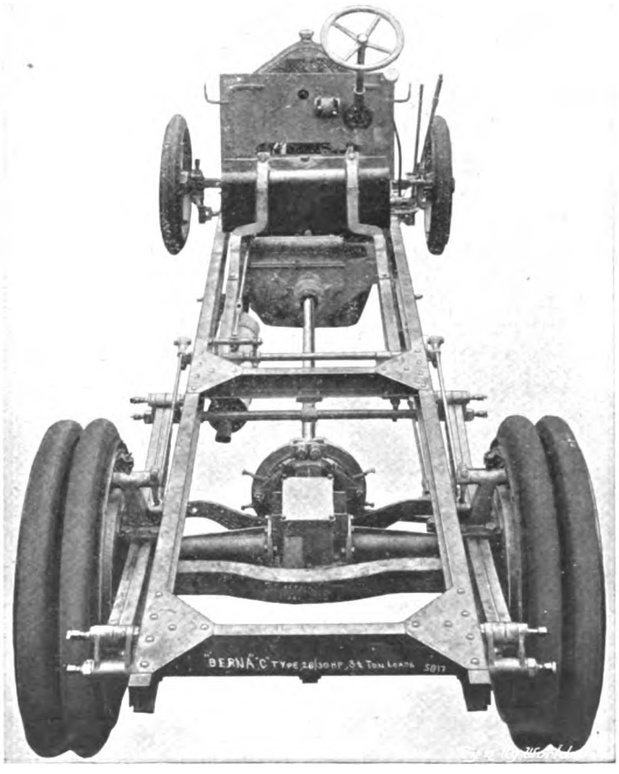

Berna 3½-Ton Chassis. Rear View Showing Differential and General Arrangement.

THE NEW 3½-TON

BERNA

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IS FITTED WITH
BALL-BEARINGS THROUGHOUT
AND SPECIALLY DESIGNED

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Telephone: 4542 WESTERN.
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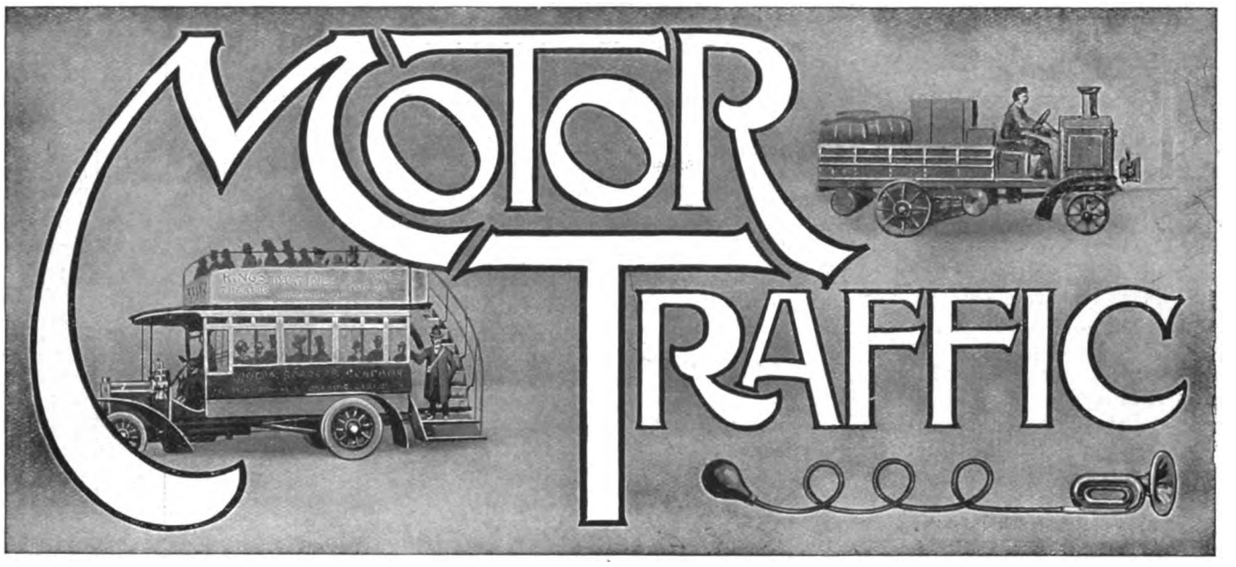

The fuel question continues to be the all-absorbing topic of interest with the users of industrial motor vehicles. Owners now fully realise that for a variety of reasons little, if any, reduction in the price of petrol can be expected while the demand for the spirit is maintained in anything like its present volume, and its supply is regulated in the manner which at present obtains. During a recent conversation with a well-known authority on the importation and distribution of petrol, we were assured that the present high prices are due not only to the extraordinary demand which has sprung up within the last year or two, but to the cost of freightage and the expense of distributing the spirit. Under these circumstances it is obvious that the steps that are being taken to produce an efficient home-made substitute is the only remedy that is likely to relieve a situation which, if allowed to continue, will have a most serious effect upon the motor industry. During the past month a number of trials of more or less importance have been carried out with a variety of fuels, and of these the best results have been obtained with a benzol mixture —90 per cent. pure benzol with 10 per cent. toluol. This mixture not only gives a better mileage than pure benzol, but the presence of the heavier liquid reduces the freezing point to a very considerable extent, so that from that point of view 90 per cent. of benzol becomes a most suitable fuel for use in all parts of the United Kingdom.

The efficiency of the new fuel is approximately 5 per cent. higher than petrol, while the present price compares most favourably, ranging from 9d. to 1s. per gallon according to quantities. In practice 90 per cent. benzol, as the fuel is commercially known, appears to be quite as satisfactory as petrol. Moreover, the odour from the exhaust while distinctive is far from unpleasant. Benzol is a by-product obtained in varying degrees of purity from gasworks and other coke-making plants, and it is largely used at present in the manufacture of aniline dyes, although it has been used to some extent as a motor fuel on the Continent. The principal point of interest at the moment is the question of supply. Taking the entire output of the present coking plants in the United Kingdom it is estimated that less than 25 per cent. of the quantity required by motor vehicles alone would be forthcoming. Naturally a number of additional plants will be installed directly the demand is apparent, and in view of the wide possibilities opened up by the satisfactory nature of the recent experiments it is reasonable to suppose that special attention will now be given to the production of the spirit on a thoroughly commercial basis. The Society of Motor Manufacturers and Traders, who have voted the sum of 2,000 guineas to the proposed fuel trials by the Royal Automobile Club, have suggested to the club that a special committee be formed to deal with the benzol question. At their meeting in December the Club Committee stated that the matter was to be discussed at the next meeting of the Petrol Committee, and it was therefore decided to defer consideration until after that meeting, a decision which was approved by Mr. E. Manville, president of the society. At present benzol, like paraffin, does not bear the Excise duty of 3d. per gallon imposed on petrol for the supply of funds to the Road Board, but there is reason to believe that the taxation of alternative fuels is under consideration.

A saving of not more than one-sixteenth of a penny is estimated to be the amount which would revert to the public if the vessels now being built to carry 12,000 tons of spirit are allowed to come up to Purfleet to discharge, instead of being restricted to Thames Haven. This is the estimate of a special committee of the Port of London Authority, which had the assistance in their inquiry of Sir Boverton Redwood and Professor V. B. Laws, two experts who have taken part in the proceedings of the special committee which have sat at the Home Office to investigate matters connected with the transport of petrol. Since the representatives of the oil companies, who gave evidence before the Petrol Committee, were firm in declaring that if they could prevent it there would be no lowering of the price of petrol, the smallness of the estimated reduction will occasion no surprise. The Port of London Authority's inquiry was carried out in consequence of suggestions made during the late strike in the London Docks, and in advising against allowing the tank steamers to unload beyond Thames Haven, the committee declare that the contrary course would be fraught with serious risk to shipping in the narrower parts of the river and to the industries situated on the river banks. The report, which has been adopted by the authority, recommends that tank barges carrying the spirit above Thames Haven should be increased in size. Motor users in the Midlands and the North may in the course of a year or two look for a slight reduction in the price of petrol, on account of the passage this session of a bill to permit of the

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MOTOR TRAFFIC.

construction of a pier at North Killingholme, on the Humber, where the Admiralty are also providing oil storage.

At one time the dominant tone adopted by the oil companies' delegates before the Petrol Committee seemed likely to arouse motorists to action. Apparently the Automobile Association and Motor Union have abandoned their plan for obtaining cheaper petrol for their members, and the "Motor Owners' Petrol Combine, Limited, in formation," seems to have rested content in announcing, early in November last, that "the preliminaries have given them access to 60,000 motorists, and that owing to the state of the market it has been decided to defer the issue of capital of £1,140,000," wherewith to provide "producing oil wells, tanks, steamers, road and railway stock, distributing depots in chief dock centres and inland towns, and a refinery in England."

The partial failure of the business side of British Army administration was demonstrated by the report of the Commission which sat at the close of the Boer war, and thus far there has been no test of the reforms that were subsequently instituted. Very little seems to be known of the capabilities of the Mechanical Transport Committee, which has since been brought into existence to formulate, amongst other things, specifications for the construction of motor vehicles, in order that by payment of subsidies a sufficient number may be at the service of the country in time of war, and for manœuvres. During the past year only two manufacturers submitted lorries for the 30 cwt. and 3-ton vehicle tests, and a further trial is to take place on January 9, and 21 following days. Entries are also being taken for a trial to be held in July next. The result of the trial already decided was that one firm gained a certificate of the suitability of their vehicle. An article contributed to the "Royal Engineers' Journal" by Capt. R. K. Bagnall Wild sets forth reasons for the slowness of manufacturers in entering their products, and it is gratifying to find that he gives no expression to criticism of the competence of the committee. His first excuse is that the makers are fully occupied in producing their own standard types; secondly, heavy initial expense is entailed in constructing a new type; thirdly, the military specifications are more costly to build to; and fourthly, many of the War Office requirements are not needed by the purchasers of commercial lorries, thus rendering sales of the approved vehicle more difficult despite of the portion of the subsidy paid to the purchaser. Captain Wild's conclusions may be taken as well founded, for he was the first secretary of the Mechanical Transport Committee, and he has also acquired a knowledge of the commercial vehicle business. Amongst other activities he served for a number of years on the committee of the Commercial Motor Users' Association, acting as chairman of the annual parade of vehicles in London. That he is now engaged in the management of a firm manufacturing industrial vehicle is not to be regarded as rendering his opinions biassed; on the contrary, it increases the value of his views.

It is to be feared, however, that the suggestions which Captain Wild advances in the article referred to will not find acceptance, for the all-sufficient reason that in this country the Treasury cannot be induced to act in the thorough manner which marks the action of the State in matters military in Germany. The latter country, he mentions, grants a heavy subsidy to induce civil firms to adopt motor transport, hence the military authorities are able to ensure the adoption of their specifications, while at the same time heavy duties doubly protect the manufacturer against competition. Captain Wild's article, while setting forth the advantages of the German system, refers to all subsidy schemes so far in operation as failing to produce exactly the vehicle required, and as being more or less costly. What, then, is his alternative to the present scheme in this country, and to the power which the State possesses in time of emergency of commandeering private vehicles? Taking as his justification the existence of State enterprises such as the Post Office, and the telegraph and telephone systems, he advocates the institution of a State transport company at an estimated capital outlay of £1,400,000. Beneficial as such an organisation would prove in many ways to motor manufacturers and to users, the proposal might arouse great opposition, particularly from railway companies, even though the latter would stand to gain by its operation.

There can be no question that, given equal fares, a large section of the travelling public prefer the motor omnibus to the tramcar, so that where the two are in direct competition the motor vehicle is sure to get a fair share of the traffic, quite apart from the action of the driver and conductor. When, however, we take into consideration the fact that, with few exceptions, each driver and conductor in the employ of either of the motor omnibus companies operating in London is an active agent working in the interests of his shareholders, it is only reasonable to expect that the natural advantages of the more flexible system will be utilised in a manner eminently satisfactory to the proprietors of the undertaking. In the days of the horse omnibus the driver was a distinct asset of the company, both in regard to the skilful piloting of his vehicle at the points where traffic was to be obtained, and also on account of his geniality and ready wit. Although with the passing of the horsed vehicle this type of public servant has become extinct, the vacancy has been filled by men who, taken as a class, command the respect of all interested in the traffic problems of London, both on account of their skill and their devotion to duty. Despite the extraordinary demands which at times the exigencies of the traffic make upon them, the manner in which they assist their conductors to gather in every possible fare, can only be regarded as remarkable. By the manner in which the average conductor performs his duties it can be readily understood that the collection of fares is not regarded by him as the sole object of his existence — the convenience of the public is his first care, the rest following as a matter of course.

In comparison with the courteous attention which the public invariably receive at the hands of the motor omnibus staff, we fear that the methods of the tramway staff leave much to be desired. At a recent meeting of the Walthamstow Urban Council reference was made to a complaint which had been received with regard to the manner in which the tramway staff performed their duties. As the manager was requested

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MOTOR TRAFFIC.

to give the men some instruction as to their duty to the public, it would appear that the members of the Council considered the complaint more or less justified. At the same meeting the report of the Tramway Committee, recommending the reduction of fares in order to meet the omnibus competition, was also considered. The two reports, taken in conjunction, are certainly significant, and are capable of the inference that the one is to some extent in consequence of the other. Whether by reason of the fact that they are municipal employees, and therefore consider themselves not under the direct control of the management as in the case of the omnibus men, or have mistaken ideas as to their duty to the public, there is no gainsaying that far too many tramcar men as a rule do little or nothing to encourage traffic. On more than one occasion we have seen would-be passengers needlessly left behind at a stopping place, and afterwards picked up by a following motor 'bus. Judging from the automatic manner in which the average tramway man performs his duties, his work would appear to consist entirely of running the car between two given points as nearly as possible to a given time, and the collection of fares from the passengers who succeed in boarding the vehicle during the moments it is at rest. However satisfactory this system may have worked when the tramcar held the monopoly of the streets, in the face of the thoroughly efficient methods adopted by the omnibus staff, and the fact that all the best paying routes are now served with the improved type of motor vehicle, it is an easy matter to account for the preference which the public show for the motor omnibus and the consequent falling in the tramcar receipts.

WAR OFFICE MOTOR SUBSIDY TRIALS, 1913.

The Mechanical Transport Committee of the War Office are holding a further series of trials of petrol lorries to qualify as type vehicles suitable for earning the War Department subsidies, similar to those carried out in August last. The trials take place during January, on a route appointed by the War Department, and on January 24, at Aldershot. The latest date of entry was December 1. On a type of vehicle successfully passing the trials the manufacturer is granted a certificate under which suitable customers purchasing similar vehicles may have them enrolled and obtain the War Department subsidies.

RESULTS OF A TRIAL HELD IN 1912.

In some notes on the progress of the subsidy scheme during the present year the War Office Mechanical Transport Committee report that all the firms on the War Office list were invited to enter for trial a type vehicle built to specification, the distance comprising 1,500 miles, including long and difficult hills, the steepest gradient being 1 in 6. As a result of this first trial, held in August last, one Class A (to carry 3 tons) and one Class B lorry (to carry 30 cwts.), both manufactured by Leyland Motors, Limited, Leyland, Lancashire, were granted certificates by which exactly similar vehicles manufactured by the firm and sold to customers in this country may obtain subsidies amounting to £110 paid in half-yearly instalments. The fuel consumption on the larger vehicle for the 1,500 miles worked out at, approximately, 60 gross ton-miles per gallon, which with a vehicle weighing 7½ tons all told means eight miles to the gallon. The average speed was practically 12 miles per hour. Plans of other lorries have been passed, and but for unfortunate delays, caused by late delivery of materials, etc., type vehicles built to these designs would have been tested at the August trials. It is anticipated that some of these lorries will have passed their tests and received certificates before the end of the present year.

Advantage was taken of the trials to test the value from the military point of view of some types of motor omnibus which are to be found in large numbers on the London streets. Specimens were subjected to a certain number of days' trial along with the subsidy-type lorries, and some very valuable data were obtained as to their comparative wear, performance, and accessibility.

OMNIBUS ADVERTISING IN LONDON.

The directors of the London traffic combine are leaving nothing to chance. A liberal use of the morning, evening, and weekly newspapers is being made for display advertising of the motor omnibus services, which have penetrated every tramway route in London and many by-ways. Fortunes have been made in the business world through forceful advertising of sound goods, and it will be interesting to observe the measure of success achieved by publicity when used as a weapon for competing with tramways. A noble member of the Moderate majority on the London County Council announced a few weeks ago that "the trams were going to fight the 'buses." So far the only indication of fighting, which is more costly than working agreements, is a reduction of fares, accompanied by failure to make the reduced fares known. The only indication to the outside public so far is the appearance of a few notice boards on dash boards of some car platforms. Hidden as these are in the traffic, they might as well not be affixed. There is plenty of room for a bold announcement at the sides of the top decks. A good point about the advertisements of the London General Omnibus Company is that they are not confined to public traffic inducement, and promote hiring. Steps are also being taken to instruct passengers and non-passengers, adult and juvenile, in the prevention of traffic accidents.

NATIONAL STEAM CAR COMPANY.

In moving the adoption of the report and the payment of a dividend of 10 per cent., as against 8 per cent. for the previous year, Mr. W. S. Coles, chairman of the National Steam Car Company, said there was no suggestion that that company should be absorbed in the London traffic combine, and the board saw a bright future as an independent unit. If they eventually proved, as he believed they would, that their steam 'bus was superior to its petrol rival, it would seem that, being the only makers in the field, they would reap a great harvest through the ownership of these patents. Their engine, for instance, was particularly suited for light locomotives, and in the last few months they had been approached through the intermediary of one of the largest firms of locomotive manufacturers in the world and by three railway companies—one in England, one in South America, and one in South Africa. At the date of the balance sheet their 'buses had cost £55,838, or less than £700 each. That cost had a tendency to come down as more were produced, and in the past year they got it down to less than £600. They had 84 fully licensed 'buses all of the same type, and expected to have 150 during the present year, and 250 by the end of 1914. A test of a 'bus for military purposes resulted in 193 miles being traversed in one day with its allotted load under War Office supervision.

DAIMLER COMPANY TO SELL L.G.O. CHASSIS.

Now that the London General Omnibus Company are approaching the limit number of motor omnibuses which can be used, the Walthamstow works have been placed under the control of a company known as the Associated Equipments, Limited, with offices at Electric Railways House, Broadway, Westminster, and steps are being taken to place the company's productions upon the market. The Daimler Company, of Coventry, have been granted the sole selling rights throughout the world for the machines manufactured at Walthamstow, where Mr. W. J. Iden is the chief engineer. From these works 2,230 chassis had been turned out up to the middle of December, the manufacture of the improved B type dating back to October, 1910. It is not proposed at present to undertake the building of motor vehicles other than omnibuses.

INSTITUTION OF AUTOMOBILE ENGINEERS.

For the fourth meeting of the present session, at the Institution of Mechanical Engineers, Storey's Gate, Westminster, on January 8, the council had arranged for a paper to be read on "The Training of Automobile Engineers," by Messrs. B. W. Ainsworth, H. Burchall, C. E. G. House, and G. Campbell Taylor, members of the committee of the London branch of the graduates' section. A point of special interest in connection with this paper was that the authors having recently completed their course of education, were probably peculiarly well fitted to deal with the subject, and to point out the weaknesses in the courses of instruction which have hitherto been open. The subject is one of extreme importance at the present time to the industry generally, and although many schemes for prescribing a definite course of training for engineers generally have been discussed without result, it is hoped that by confining the discussion to a course designed for this particular branch alone, some tangible result may be arrived at.

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MOTOR TRAFFIC.

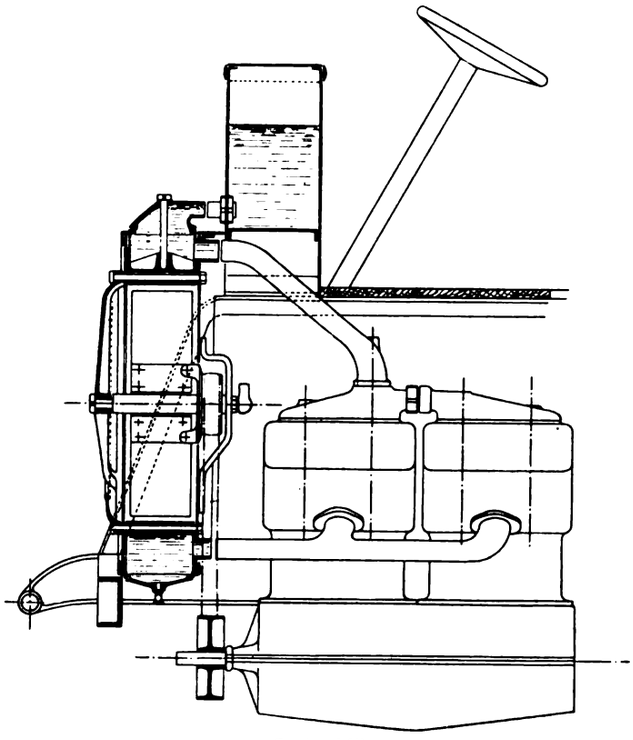
THE SOLEX RADIATOR.

An important improvement in the service of heavy motor vehicles has been made possible by the introduction of a new type of radiator which has been specially designed for this class of conveyance. With inefficient cooling arrangements the best designed engine will fail to give satisfaction, and the greater the horse-power the more difficult the problem becomes. The various types of radiators in use on industrial vehicles at the present time need constant attention in order that the losses of water due to evaporation may be made up, and quite apart from the fact that in the case of large fleets this becomes a charge of some importance, there is the result that as the water reaches a very high temperature it must necessarily reduce the efficiency of the cooling system.

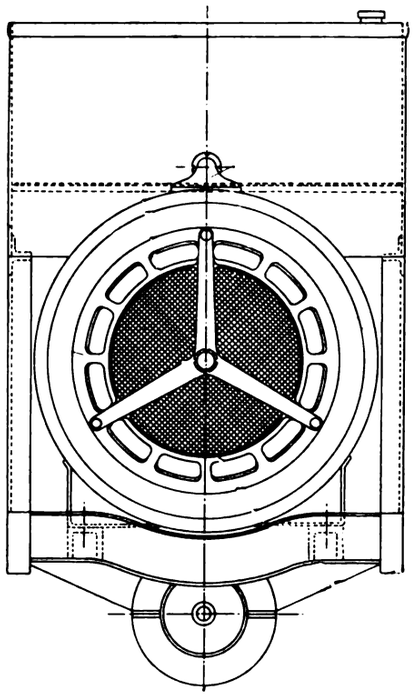
The Solex radiator has been devised for the cooling of heavy motors. It has an intense cooling action, and is constructed with due regard to the vibration to which the vehicles are subjected, also to withstand the hard wear inseparable from public service.

A good idea of the form of the Solex radiator will be gathered from the illustrations on this page, and the following is a brief description of its construction and working. The radiator consists of three main parts, the casing, the tube section, and the fan. The casing, of sheet steel, protects the tubes from damage due to vibration or wear. It is furnished with lugs, by which the radiator is fixed to the chassis. The tube section consists of a series of segmental copper tubes connected to two collectors, which are cast in bronze, thus ensuring ample seating for the tubes at the joint in holes of exact size and a perfect fit. The upper collector is provided with a reservoir if desired, otherwise, there is a metal cap, but either can easily be removed for the purpose of cleaning or repairs if necessary. The tube section is fixed to the casing by two bolts inserted through the collectors without passing through the water, thus insuring free play for the tubes.

The fan is mounted inside the tube section, and runs at a considerably lower speed than a propellor fan. It is mounted on a fixed spindle and runs on ball bearings. The spindle has its bearing in the casing at the back and in an aluminium spider frame at the front. An important feature in the design of this radiator is its simplicity and the ease with which the parts can be removed. By unfastening four bolts in the spider frame the fan can be taken out bodily, slots being formed in the casing for the passage of the blades, while the whole radiator can be removed from the chassis in a few minutes. Altogether this arrangement appears to form an extremely strong and efficient radiator. After lengthy trials, the Solex radiator has been exclusively adopted by the Compagnie Generale des Omnibus of Paris for its 800 new motor omnibuses, and Thomas Tilling, Limited, have also decided to have them fitted to their new petrol-electric omnibuses now under construction at the works of W. A. Stevens, Limited, at Maidstone.

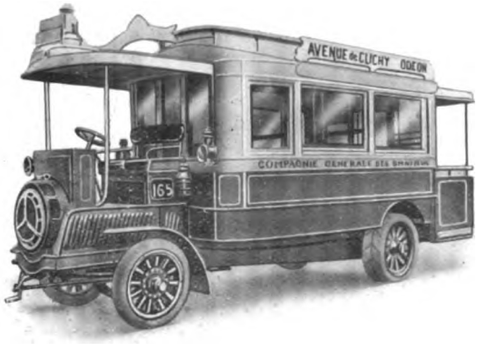


Sectional View.

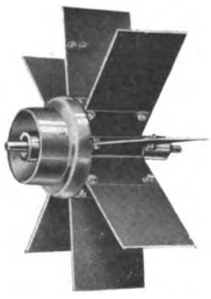


Front View.

Solex Radiator.



Omnibus, with Solex Radiator.



Solex Radiator Fan.

Tube Section, in which Fan is Mounted.

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MOTOR TRAFFIC.

The reports from Paris are eminently satisfactory, the loss of water due to evaporation being practically nil. Amongst those on the Continent who are fitting the "Solex" radiator are Schneider and Cie, De Dion Bouton, Vinot and Dequingang, Mercedes, the Ministére de la Guerre, the Ministére de la Marine, Panhard and Levassor, Renault, Aster, Gnome, and the Italian Government.

THE LATEST LONDON AMALGAMATION.

A meeting of the shareholders of New Central Omnibus Company, held on December 16, Mr. J. O'Connor, M.P., presiding, passed the following resolution unanimously: "That the agreement of the 3rd day December, 1912, made between the New Central Omnibus Company, Limited, of the one part, and the London General Omnibus Company, Limited, of the other part, be and is hereby approved." The chairman mentioned that the company had operated a route between Chalk Farm (North London) and Waterloo station, and also to Kingston. They had a working agreement with the London General Omnibus Company, but lately the many services inaugurated by the latter in close proximity rendered the agreement of less value. As the result of representations to the company, the present excellent agreement had been made, providing for the letting of their fleet of 100 vehicles, accommodating 3,400 passengers, to the London General Omnibus Company for a term of 20 years. The rent would be a sum equal to that proportion of the net trading profits of the company which the seating of the vehicles taken over bore to the seating accommodation of the omnibuses owned and run continuously by the London General Omnibus Company; or a sum of £8,000 at the option of the company. The company could exercise this option once in every three years. The vehicles were to remain the property of the company, and were to be run and licensed in their name, and to be maintained in the best running order and in all respects up to date. He believed it had been stated that the profits of the London General Company for the year ended September 30, 1911, were approximately £349 per omnibus per annum. The average annual profits per omnibus in service of the New Central Company, computed on the returns for the nine months ended September 30, 1911, amounted to £240 per omnibus per annum. They were partners with the London General Company in their success without participating in any bad trade they might experience, in which latter case this company could and would exercise its option at the first opportuuity. In return for this agreement the London General Omnibus Company had undertaken not to be concerned in the running of omnibuses within a radius of 30 miles of London or 10 miles from Bedford, where the New Central had started a service; but these were the only restrictions, so that, if it is thought wise, this company could still continue its activities in the provinces and continue its policy of extension. This company could not make a trading loss. The paid-up capital was not quite £100,000, and an excellent return should be shown.—The report stated that for three years the London General Omnibus Company would pay a sum equal to the present remuneration of the board, and after that date remuneration at the rate of £100 per annum for each director during the term. The present managing director was to be taken over by the London General Omnibus Company, with a right to him to rejoin the board on special terms mentioned in the agreement. At a special meeting on January 2 the shareholders, by an overwhelming majority, empowered the present directors to continue to hold office during their lives as long as the agreement continued, and also authorised them to fill any vacancy.

PROPOSED OMNIBUS MUD-GUARD BY-LAW.

It was reported to the London County Council recently, by the Local Government Committee, that complaints have, from time to time, been made to the Council of nuisance caused by the splashing of mud by motor omnibuses and similar vehicles on to the person and clothing of pedestrians and on the windows of shops. As there appears to the committee to be ground for the complaints, it is proposed to consider the question of recommending the Council to make a by-law under Section 23 of the Municipal Corporations Act, 1882, and Section 16 of the Local Government Act, 1888, with a view to secure an abatement of the nuisance.

Splash Prevention Trials in France.

At the mud-guard competition for motor vehicles, recently held in Paris, the first prize, given by the municipality, was awarded to Messrs. Garcher for a straight rubber band which was fitted on each side of the wheel. The effect of this device was to throw the mud to the rear, the band being depressed by the revolution of the wheel. This was the only invention which provides a rubber band on both sides of the wheel, but there were a number with a band on the outside only. A representative of the traffic department of the Metropolitan Police attended the tests.

STOPPING PLACES OF TRAMCARS AND OMNIBUSES.

At the meeting of the London County Council on December 17, the Highways Committee recalled negotiations which had taken place with the Board of Trade regarding by-laws for the working of the tramways at Hammersmith Broadway. The Board of Trade by-laws proposed that all cars should come to a standstill opposite a new street refuge, but the Board subsequently, at the instance of Hammersmith Borough Council, altered the by-laws by the addition of the words "subject to any police regulations." The committee informed the Board that the Council objected very strongly to the insertion of the words. The Board had since replied to the effect that they were advised that having regard to the busy nature of the thoroughfare, the by-laws should be retained in their altered form.

The Hammersmith Borough Council had drawn attention to the danger and confusion created at Hammersmith Broadway and at the junction of Uxbridge Road and Goldhawk Road by the stopping of tramcars and motor omnibuses at the same places. The Borough Council stated that they had been in communication with the Commissioner of Metropolitan Police, the London General Omnibus Company, and the London United Tramways Company on the subject. The Borough Council also stated that pending the conclusion of the House of Commons Select Committee inquiry regarding motor omnibuses, it would be possible for the County Council and the Omnibus Company to arrange between them an immediate, although temporary, removal of the dangerous condition of things. The Omnibus Company and the London United Tramways Company had already agreed to discuss the matter with representatives of the Borough Council, and if thought desirable with County Council representatives. The Highways Committee recommended that arrangements be made for the County Council to be represented at any such conference. The General Purposes Committee proposed that the chairman of the Highways Committee and the chief officer of tramways should be the Council's representatives.

The report was adopted.

IMPORTANT PROSECUTION OF OMNIBUS DRIVERS.

At the instance of Mr. H. E. Blain, manager of the West Ham Corporation Tramways, two drivers of motor omnibuses were summoned at West Ham, on January 2, for driving to the danger of the public by "cutting in" in front of tramcars at stopping places. In the first case the evidence showed that in the narrow part of West Ham Lane, Stratford, the defendant, driving a motor 'bus, passed across the front of the car, within 18 in. of it, and pulled up on the near side. The car driver had no time to apply his brakes and only avoided a collision by reversing. About 20 passengers got off defendant's 'bus, and then he drove it leisurely in front of the car to another compulsory stopping place.

The defence was that the car was stationary, and that the 'bus was pulled up six or seven yards in front.

Mr. Blain said he had written repeatedly to the London General Omnibus Company as to the practice, which took place at nearly every stopping place, and was not only a nuisance but a positive danger to the public.

Mr. Gillespie said it was a serious case, and one which might have caused a serious accident; and it appeared to be a common practice. Defendant would be fined 40s.

In the second case it was said that a crowd of persons were getting on to a car when the defendant drove between the car and the kerb. The people had to scatter, and had not the tramcar conductor pulled a woman on to his car she must have been knocked down. In this case a fine of £2 was also imposed.

PRICE OF PETROL BY CONTRACT IN LONDON.

A year ago the motor cab companies of London made contracts at 6d. per gallon for petrol, to which had to be added 1½d. for half of the petrol duty. This year's supply is to be at 11d. per gallon, together with the half duty. Meetings of motor cab drivers have been held and resolutions passed refusing to pay the increased charge of 5d. to the men's employers and promising to support the executive in any action they deemed necessary. On January 1 some 5,000 of the drivers came out on strike. Two days later the strike extended to the provinces, although the provincial drivers are not members of the London men's union.

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MOTOR TRAFFIC.

LONDON STREET TRAFFIC ENQUIRY.

The Select Committee of the House of Commons appointed to enquire into accidents arising from motor traction in London, sat on December 17 and 19. Sir George Toulmin presided, and evidence was given by Sir William Byrne, assistant under-secretary in the Home Office; Mr. W. T. Jerred, an assistant secretary to the Local Government Board; and Colonel Yorke, chief inspecting officer of railways to the Board of Trade. Each of these witnesses defined in detail the powers of their departments as regards the traffic question generally under existing legislation, and expressed themselves satisfied that so far as their own department was concerned the law is sufficient and adequate for its purpose. At the same time, Sir William Byrne received the approval of the Committee when he remarked that speaking generally, the legislation on the subject of London traffic is redundant, defective, overlapping, and difficult to understand. None of the witnesses have been authorised by their departments to express officially any opinions as to what course should be taken in the future to mitigate accidents of the kind which the Committee have been appointed to enquire into, but they made certain suggestions which have come before the authorities, and which, in one or two instances, they expressed personal opinions upon. A proposal that imprisonment should be inflicted for a first offence against the Motor Car Acts did not meet with the approval of Mr. Jerred, nor did Sir William Byrne acquiesce in another suggestion that the onus of proof of negligence in the event of an accident between a motor vehicle and a pedestrian should be shifted from the pedestrian to a motor driver. At the same time, his view that juries are at present sufficiently disposed to find against motorists was disputed by several members of the Committee.

Present Powers of Control.

Members of both shades of political opinion upon the Committee have been very keen in their questions to bring out the multiplicity of control in London traffic matters, the authorities having a hand in these being as follow: Board of Trade, Home Office, Local Government Board, Police, Traffic Branch of the Board of Trade, London County Council as regards their parks, and Office of Woods and Forests as regards Royal parks. Owing to the restriction under which all the official witnesses suffer of not being allowed to express opinions on such a delicate matter, no definite information has been forthcoming to the Committee as to the possible advantages from concentration of the control under one authority. That the present condition of affairs leads to confusion is clear from the fact that during Colonel Yorke's evidence on December 19, certain figures which he put in, showing that the number of tramway accidents in London in proportion to the mileage run had considerably decreased of recent years, were found to be quite different from similar figures published officially by the Commissioner of Police. The nearest approach to a definite opinion upon the question of a traffic authority was made by Mr. Jerred, who stated that probably some advantage might be secured by an Advisory Committee consisting of representatives of the Home Office, Board of Trade, and Local Government Board. Such a body should evidently have some official powers, however, and another point brought out during the evidence was that although the Traffic Branch of the Board of Trade exists for the purpose of advising with regard to traffic matters, yet the Local Government Board have never yet consulted the Traffic Branch on any matter relating to London traffic.

Speed Limits and Stopping Places.

As to speed limits, both the Local Government Board and the Commissioner of Police are averse to fixing these unless the circumstances are quite exceptional. A great point was made by members on the Liberal side of the Committee that whereas the Board of Trade had complete control in respect to tramways, motor omnibuses were free from any control as to the routes, even from the police.

The Chairman, during Colonel Yorke's evidence, suggested that it might be in the interests of safety if tramways could be so constructed that at certain definite stopping places they were carried to the kerb, so that passengers could enter or alight from the cars in safety from the other traffic on the road. Colonel Yorke was against such a suggestion as impracticable. Incidentally, he rather took credit for the fewer number of people killed by tramways than by motor 'buses, on the ground that it was the function of his department to look after tramways from the point of view of safety both to the public and the passengers. In connection with accidents, he pointed out that in the case of the London County Council recently two instances where a tramcar passenger had been knocked down by a motor 'bus after having just stepped off a tramcar were reported to the Board of Trade as tramcar accidents, which, however, he thought was hardly the case. Dealing with narrow streets, Colonel Yorke also expressed the view that it was better in these to have the tram lines on the side of the road, and he had a preference for doing this in any street where there would be less than 9 ft. 6 in. between the rail and the kerb if the line were laid in the centre of the road. From Sir William Byrne's evidence, it would appear that the question of limiting the number of omnibuses in certain classes of streets has been under consideration, but under the existing law this could only be done where the conditions were held to be "especially dangerous," or where the road was less than 16 ft. in width. This, he explained, included the footpaths, so that the actual width of the roadway, assuming a 4 ft. pathway on either side, would only be 8 ft.

The Committee adjourned until after Christmas.

Life-Guards.

The Committee resumed their sittings on January 2, when further evidence was heard from Sir Horatio Yorke, chief inspector of railways and tramways. After pointing out that there are 72 miles of so-called tramways in the metropolitan area constructed under light railway orders, these being distributed in Barking, Dartford, Hertford, London United System, South Metropolitan Company, County of Middlesex, and Walthamstow, the question of accidents on the London County Council system was gone into. The following figures for the years 1908 to 1912 show that there has been a decrease in accidents, notwithstanding that there has been a considerable increase in the number of passengers. This is attributed to increased skill on the part of the drivers, improvement in brakes, and careful maintenance of life-guards. In 1908 the number of passengers was 597·14 millions; persons killed, 48; and injured, 731. In 1909 the figures were 637·36 millions, 39, and 1,874; in 1910, 705·97 millions, 45, and 1,313; in 1911, 780·97 millions, 36, and 918; in 1912, 809·37 millions, 38, and 1,062. These figures were again challenged by Mr. Kellaway, a member of the committee, as being quite different from those quoted by the police.

Sir Horatio Yorke's main evidence was devoted to tramway life-guards. The Tidswell type, he said, has been eminently successful, and the Board of Trade, although they have no power to prohibit the plough type of guard adopted in Liverpool, apparently do not regard it as so satisfactory. Figures for the County Council system were quoted, showing that from January 1 to December 31, 1912, 23 people were killed and 436 injured. In 43 cases the guard came into action, and in 41 the person was picked up. In five out of the 41 cases the person picked up was dead, and was found to be suffering from injuries which it was, said witness, fair to assume were sustained before the guard came into operation. In 32 cases the person picked up was injured, not seriously, and in four cases without any injury. In the two cases in which the guard failed to pick up a body, children were involved, and the possibility of a small child getting under the swinging gate some distance before it came into operation, thus bringing down the tray on the child instead of underneath it, was pointed out. The Glasgow returns for November show that in 10 cases a person or child was picked up by life-guards. The question of side guards between the wheels and the truck, and also between the front wheels and the swinging gate, was discussed, but the feeling of the Board of Trade is that no hard and fast rule can be laid down with regard to this.

Sir Horatio Yorke was questioned as to fitting guards to motor omnibuses, and he frankly said he would express no opinion, as he had not had an opportunity of studying an omnibus chassis from this point of view. Speaking without such knowledge, he anticipated that it would be impossible to fit a guard of the Tidswell type to a 'bus, and that in any case some considerable modification of the chassis would have to be made if a guard were to be fitted. A plough might be fitted to an omnibus, but, as already pointed out, the Board of Trade are not in favour of this, although, as a matter of fact, they have no jurisdiction over omnibuses. Sir Horatio Yorke confessed that he was not keen on omnibuses being placed in charge of his department. It may be pointed out that experiments are being carried on by the London General Omnibus Company with 'buses fitted with rear-wheel guards. The question of speedometers on tramcars was the subject of many questions, and the only extent to which Sir Horatio Yorke would commit himself was to say that if a reliable apparatus could be obtained the Board of Trade already had a regulation insisting upon its adoption.

Evidence from the City Corporation was commenced in the afternoon. This had, for the most part, reference to the powers of the Corporation as to control of traffic. Sir Homewood Crawford, the city solicitor, said the Corporation would strongly object to tramcars elsewhere than on the Embankment, and especially to a connection between Blackfriars Bridge and Farringdon Road, along New Bridge Street. They were quite willing, however, to allow tramways to be run under the surface, as was to be done in connection with the new St. Paul's Bridge.

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MOTOR TRAFFIC.

Motor omnibuses were discussed a good deal by Sir Homewood Crawford, and he differs from the City Commissioner of Police in that he would impose a speed limit in the City of eight miles per hour, instead of the 12, which now applies, whereas the Commissioner is satisfied that he can control the traffic without any speed limit. A question which, in his opinion, deserved very considerable consideration, is the consolidation of legislation as regards London traffic. The administration of any consolidated code should be in the hands of the police. The extension of the unique powers now held by the Corporation as to holding inquests upon fires, whether there have been fatal accidents or not, was suggested with regard to accidents in the streets due to traffic.

Finally, although the City Corporation have very extensive powers as to the control and diversion of traffic, yet even they cannot regulate the number of motor omnibuses on the streets, and Sir Homewood Crawford expressed the opinion that there should be power to regulate the routes which omnibuses should cover, although he did not actually suggest that the number of omnibuses on the roads should be limited.

EFFECT OF THE RIVALRY AT WALTHAMSTOW.

As a result of the keen competition between the motor omnibuses and their tramways, the Walthamstow Council have given the tramways manager instructions to prepare a report upon the effect of this competition, with a view to further reductions if found advisable. From the commencement of the Walthamstow tramway service in 1905, the most profitable section has always been the line from the Lea Bridge Road through Hoe Street on to Chingford Mount, a distance of some three miles, for which a charge of twopence was made for the full journey, with intermediate halfpenny and penny fares. Recently the London General Omnibus Company commenced a through service from the Elephant and Castle in South London, to Chingford Mount, *via* Lea Bridge Road and Hoe Street, with the result that the tramway receipts have steadily fallen. It is in order to recover some of the lost traffic that the Tramway Committee wish to issue full journey return tickets for threepence, and corresponding reductions on the intermediate fares. In connection with the fall in the tramway receipts a question was raised at the Council meeting as to the manner in which the members of the tramway staff performed their duties, the inference being that compared with the omnibus staff much remained in favour of the latter. It is understood that the tramways manager was given full power to deal with this matter forthwith.

"KYL-FYRE" DEMONSTRATION.

Some demonstrations which were recently given in Store Street, Tottenham Court Road, London, clearly showed the remarkable fire extinguishing powers of "Kyl-Fyre." Unlike all other chemical fire-extinguishers that have been placed upon the market, "Kyl-Fyre" is in the form of a powder. It is contained in a cylindrical tube 18 in. long by 3 in. diameter, and weighs 6 lb. The powder does not deteriorate, and therefore is always ready for use, no matter how long it has been in stock. Being a non-conductor and harmless to the most delicate machinery, it is claimed to be the most effective and suitable extinguisher for fires in connection with electrical machinery. "Kyl-Fyre" is instantaneous in its action, as immediately the powder comes into contact with heat a powerful gas is generated in which no fire can live.

The following demonstrations were given, and in each case the result of the application of the powder was most satisfactory: (1) Petrol was poured into a pail and ignited; the flames were extinguished instantly by a small quantity of "Kyl-Fyre" powder. (2) A quantity of petrol was poured on the ground, covering a considerable area. This was to represent a fire which frequently occurs in a garage. The petrol was ignited and "Kyl-Fyre" applied immediately. To show that the petrol had not burnt out or evaporated, it was relit and again extinguished. (3) A tar barrel, half full of tar, standing in a pool of tar, well saturated with petrol, was set on fire and allowed to burn till the tar boiled with the intense heat. The blazing furnace was then easily extinguished by "Kyl-Fyre." (4) A large pit of tar, ignited by petrol, and allowed to burn till it became a sheet of flame, was extinguished instantly. (5) A large wooden structure, containing 1,000 ft. of battens and other inflammable material thoroughly saturated with petrol and paraffin, was ignited and allowed to burn until the whole became a veritable inferno. This was reduced to a harmless mass in a few seconds by the application of "Kyl-Fyre."

Full particulars of "Kyl-Fyre" can be obtained from "Kyl-Fire," Limited, Eastbourne, or their London representatives at 7, Mark Lane, E.C.

LONDON OMNIBUS APPOINTMENTS.

In the House of Commons on December 19,

Mr. Kellaway (Bedford, L.) asked the President of the Board of Trade when the annual report of the London Traffic Branch of that department would be published; whether Mr. Fishbourne, now assistant manager of the General Omnibus Company, had had any part in the compilation of the report; if it was known while he was engaged upon this work that he had accepted an appointment under the motor omnibus trust; and whether he was in receipt of a pension.

Mr. Kellaway also asked at what date Sir Herbert Jekyll severed his connection with the Traffic Branch to become a director of the Company; if he was responsible for the last annual report of the Board of Trade on London traffic, and signed the same on November 30, 1911; if it was known, whilst he was engaged on this work, that he had accepted a position as a director of the trust; and whether he was now in receipt of a pension from public funds.

Mr. Buxton: Sir Herbert Jekyll retired on December 31, 1911, having reached the age at which civil servants are required to retire. I understand that some months afterwards he joined the board of the Omnibus Company. He was, of course, responsible for the reports issued by the branch of which he was chief, the last of which is dated October 31, 1911. He is in receipt of a pension from public funds. The latest annual report is now in the hands of the printers, and should shortly be issued. While Mr. Fishbourne was in the service of the Traffic Branch, he was employed in the ordinary work of the branch, including the preparation of the annual reports. He informed the Department of his intention on retirement to accept a post in the Omnibus Company. Mr. Fishbourne has no pension in respect of his service in the London Traffic Branch, but it is understood that he will receive temporary retired pay whilst serving as an officer of the Royal Engineers' Special Reserve. I think that, if my hon. friend wishes to make any charge against the Board of Trade or against either of the gentlemen he has named, he ought to state it directly, and not insinuate it through questions.

TODMORDEN MUNICIPAL OMNIBUSES.

A long discussion took place at a meeting of Todmorden Council on December 23 with reference to the recommendation of the Motor Omnibus Committee for the purchase of two engines and one engine and chassis from Leyland Motors, Limited, for the inclusive sum of £1,000. Councillor Wadsworth, chairman of the committee, stated that the omnibuses had now been running six years, and the committee had come to the conclusion that two or three of the engines were practically done, and with petrol at its present price it would be more economical to purchase new engines. He thought that the mileage they had got out of the new Leyland engine purchased six months ago warranted them in taking the step now proposed. Alderman J. Dawson protested against the proposal. The committee, he said, had overspent the capital cost of the 'buses by £3,000 in five and a half years. The cost of repairs in 1909, the second full year of running, was only £1,100; in 1910 it had been reduced to £1,074; but last year, with additional experience and the new engines, it went up to £1,807. Councillor R. Dawson, as a member of the committee, stated that owing to the cost of obtaining railless trolley car powers he had supported the continuance of the motor omnibus undertaking. When Todmorden started running 'buses, they, like Eastbourne, were pioneers, and had had to pay for their experience. Taking it all round the Leyland engines had done the best work, and were much stronger built. The committee had attempted as far as possible to standardise these engines. They had already three of this type, and if the recommendation of the committee was passed they would have six. The recommendation was adopted.

EXHIBITS AT THE PARIS SALON.

The heavy motor section formed a good display at the Motor Car Exhibition which was revived at Paris in December after having fallen through for two years. The British exhibitors were the F. I. A. T. and Foden Companies, and there were also several firms who have establishments in both countries, notably the Delahaye, De Dion Bouton, Panhard, and Renault. Several motor omnibuses were exhibited. Statistics taken at the Paris Salon proved very favourable to "Continental" tyres. Of a total of 3,486 pneumatic tyres, 789 bore the familiar "Horsebrand" trade mark, while as regards solid rubber tyres fitted to the heavy commercial vehicles "Continentals" were responsible for no less than one-third of the total—and this, when 19 different makes were represented.

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MOTOR TRAFFIC.

MOTOR TRAFFIC NOTES.

SCOTTISH MOTOR TRACTION COMPANY.—A dividend at the rate of 7½ per cent. per annum has been declared for the year ended September 30 last.

CUSHIONS ON OMNIBUS TOP DECKS.—The London General Omnibus Company is providing top-deck passengers with cushioned seats. In view of the varying conditions of roads over which the vehicles travel, this attempt to give outside passengers the same comfort as those inside has been too long delayed.

TENDERS FOR MOTOR OMNIBUSES AND CHASSIS.—Warrington Tramways Committee on December 20 received tenders for the supply of three motor omnibuses, while Manchester Tramways Committee on December 24 received tenders for the supply of three motor omnibus chassis and one motor car.

MOTOR VEHICLES FOR STREET SCAVENGING.—It is announced that New York is about to utilise 35 motor vehicles for street scavenging purposes. Such conveyances have been in use for some years among municipal authorities in this country, notably by the City of London and Westminster Corporations.

DAIMLER OMNIBUSES AT HALIFAX.—The Corporation Tramways Committee have decided to provide a motor omnibus service for Siddal, a suburb of the borough, which is not reached by the tramways. The type of single-deck vehicle in use on the Mount Tabor route was illustrated in the issue of THE TRAMWAY AND RAILWAY WORLD dated December 12.

RECRUITS FOR LEEDS TERRITORIAL TRANSPORT.—At the prize distribution of the West Riding Divisional Transport and Supply Column held at Leeds on December 20, the commanding officer stated there were a few vacancies, which they wanted filled chiefly by mechanical transport men, for there was little doubt that the mechanical would soon largely supersede the horse-drawn vehicles.

"SHELL" TRANSPORT DIVIDEND.—The "Shell" Transport and Trading Company, one of the undertakings supplying petrol to this country, announce a second interim dividend at the rate of 10 per cent. Although the results of the year's trading have been exceedingly satisfactory, the directors have decided to reserve the increase of dividend until the final accounts have been received.

INCREASE OF CAPITAL OF THOMAS TILLING, LIMITED.—A prospectus was issued in December inviting subscriptions for an addition of £200,000 to the capital of Thomas Tilling, Limited, who run the Tilling-Stevens motor omnibuses in London. The company, who have a permanent agreement with the London General Omnibus Company, have 70 vehicles on the road, and with part of the new capital 80 more are to be built.

LONDON COUNTY COUNCIL "TO FIGHT THE MOTOR OMNIBUSES."—Lord Hill, addressing the members of the Greenwich Constitutional Club, contradicted a rumour that the London County Council contemplated scrapping tramways. Although it was not the Council's intention to bring forward at present any big extension, they proposed to link up the system so that there would be a complete circuit of cars. In addition, they were going to fight the motor omnibuses.

PRESSURE OF WORK IN THE MOTOR TRADE.—Replying to a local correspondent's request for larger motor 'buses in the hilly Ashley Down district of Bristol, Mr. C. Challenger, manager of the Bristol Tramways and Carriage Company, on December 17, wrote that the company were increasing the number of their chars-a-bancs as fast as they could get material from the makers of parts, but unfortunately they were as many months delivering as they promised in weeks.

MOTOR OMNIBUSES AND ABERDEEN TRAMWAYS DEPARTMENT.—Councillor Smith, chairman of the Tramways Committee, having informed the members that the department have no power to run omnibuses, except in the case of a tramway breakdown, or other emergency the committee have decided, on his motion to consider and report as to the propriety of including in the next Provisional Order power to provide, equip, and run within the city motor 'buses or motor cars.

MOTOR VEHICLES AT BATH.—The Sub-Sanitary Committee have recommended that the Bristol Tramways and Carriage Company be not granted licences for six motor cars enabling them to pick up passengers anywhere instead of as at present at the offices. Licences have been granted to the Bath Tramways Company for specially constructed motor cars for Lansdown and Bathwick Hill routes. Consideration of this company's application for licences for four touring cars has been adjourned in order to ascertain if they will restrict the use of the cars to week-days.

NIGHT CAB FARES AT LEEDS.—The City Council recently adopted a new by-law enabling a fare and a half to be charged by mechanically-driven hackney carriages when engaged between midnight and six a.m. Alderman Midgley explained that a representation had been made that there was a danger of taxi-cabs being withdrawn from the street, and that some of the companies could barely meet expenses. With the exception of London, where the conditions of night traffic were entirely different, nearly every town in the country granted the owners permission to charge the increased fare.

MOTOR LORRIES FOR SHEFFIELD HIGHWAYS DEPARTMENT.—The 5-ton lorry of 30 H.P., which was acquired by the Sheffield Corporation for the work of the highways department about a year ago, proved so satisfactory that a second vehicle of similar construction has since been obtained. The Surveyor of Highways, in a recent report, says that both are doing good service for the department, at a considerable saving in cost as compared with horse hire. Much of the work of the department has to be done under such circumstances that it is impracticable to use motor haulage entirely, but there are still other branches of the work for which motor haulage could be economically utilised.

THE AVON INDIA RUBBER COMPANY, LIMITED.—The greatly increased demand for Avon tyres which has occasioned the recent opening of several branches at convenient provincial centres for more rapid distribution has necessitated removal of the company's London depot, Long Acre, to larger showrooms and warehouses at 19, Newman Street, Oxford Street, W. A large stock of all their specialities, particularly of tyres for cars, motor cycles, and cycles, will be kept to give immediate delivery to their numerous trade friends, to whom an inspection of the new premises is cordially suggested. A staff of fitters is employed at the new premises, and customers' cars are fitted with Avon tyres free of charge.

OMNIBUSES FOR MILITARY WORK.—Motor omnibuses were used this year in the annual manœuvres of both the British and the German Army. Among the hired transport were six Milnes-Daimler omnibuses belonging to Bath Tramways Company, and these were suddenly utilised to convey a contingent of Liverpool Territorial Engineers a distance of 20 miles to place in a state of defence a 10 mile gap, 20 miles distant from their camp. In less than an hour several bridges had been placarded as destroyed and pickets posted. Concerning the Kaiser's manœuvres it is recorded that an innovation was the employment of motor omnibuses for troop transport. The surprise arrival of a heavy detachment of riflemen, who were rushed up in omnibuses, proved the decisive factor in a certain engagement. Motor cars, motor cycles, and motor trucks were used to an unprecedentedly large extent.

GENERAL MOTOR CAB COMPANY.—At the annual meeting on December 23, the chairman (Mr. M. Ritchie) stated the profit and loss account showed a debit balance of £148,922, but the debit balance on the year's working was only a small sum. The great bulk was due to a loss of £164,734 on the sale of cabs and cars. A large amount of the trading profit went to provide the £65,000 which had to be paid annually to the lenders of the £600,000. The company was reduced to the verge of bankruptcy before the reorganisation was carried out, and would have had to be sold up for the benefit of the debenture holders but for the faith shown by the French shareholders, who provided £600,000. A resolution was adopted in favour of cutting down the capital to £400,000. The Hon. Arthur Stanley, M.P., was one of the committee of management who, with the directors, took a hand in the reorganisation.

DEMAND FOR WORKMEN'S FARES ON MOTOR OMNIBUSES.—In the House of Lords on December 11 Lord Monk Bretton (L.U.) asked the Government if they could under existing legislation call upon omnibus companies in London to run workmen's 'buses at special fares, and if not, whether it was proposed to introduce legislation to deal with the matter. The County Council provided workmen's fares on their tramways at a cost of £130,000 to the ratepayers last year. In provincial towns the municipal authorities licensed motor 'buses, and were able thus to secure uniformity in traffic regulations. That illustrated the need for a Traffic Board for London. Earl Beauchamp (First Commissioner of Works) said the Government had no authority to interfere with the omnibus companies or to regulate them in any way, and he could hold out no hope that they would introduce legislation dealing with the subject in the present state of public business. Viscount Middleton (C.) expressed the opinion that something would have to be done sooner or latter in view of the enormous increase in motor 'bus traffic and the great expense entailed upon the road authorities. The immunity from rates which motor 'buses enjoyed, and the damage they did, in neither case applied to railways or tramways, and constituted a clear case for some interposition by the Government by the establishment of a Traffic Board.

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THE Tramway & Railway World

A REVIEW OF CURRENT PROGRESS IN ELECTRIC AND OTHER TRACTION

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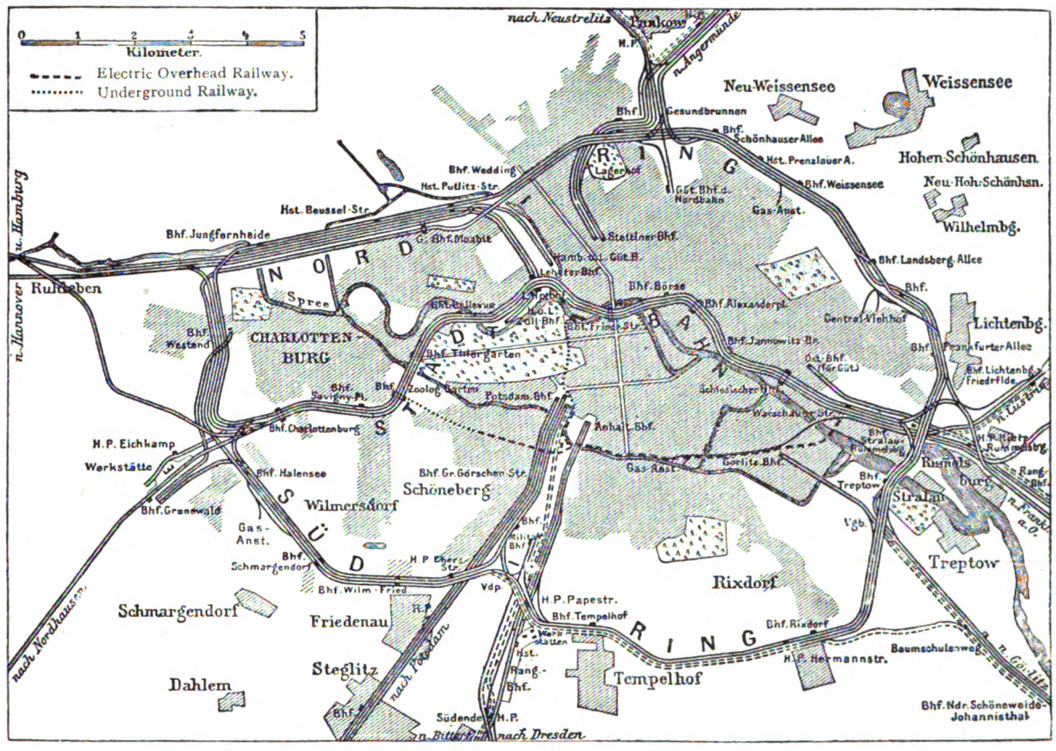
BERLIN MEANS OF COMMUNICATION.

Since the creation of the German Empire in 1871 the city of Berlin has by an uninterrupted development become one of the chief centres of the world's traffic. Year after year its traffic is assuming more gigantic proportions, and its means of communication have concurrently undergone a prodigious extension. Berlin has, in fact, come to be considered, as far as traffic facilities and regulation are concerned, as one of the best organised cities. Nevertheless, in Berlin, as in London, the traffic concerns are at present hardly able to satisfy all the demands of an ever-increasing population. The urban, circle, and suburban railways, electric street railways, elevated and underground railways, horse and motor omnibuses are constantly compelled to extend their services in order to keep pace with the city's development. Greater Berlin can now boast of an annual traffic of about 200,000,000 passengers (the nine urban railways of London convey annually about 370,000,000 passengers).

The rapid development of Berlin is chiefly due to the Urban Railway Administration. It has provided the city with a network of railways for local passenger traffic, of a kind that is unequalled anywhere else in the world. This railway system has enabled the inhabitants of the city to remove their residences into the suburbs, so that the inner parts of the city were transformed into commercial and industrial districts. As a glance at the accompanying map will show, the Urban Railway (Stadt Bahn), nearly 20 kilometres in length, from Stralau-Rummelsburg to Grunewald, forms the direct and shortest connecting link between the great International Railways reaching Berlin from the east and west. This railway forms, as it were, the diameter of the large circle represented by the Circle Railway, which, with its northern and southern circles, each being 21 kilometres long, surrounds the city. Both the Urban and Circle Railways are in direct communication with nearly all the long-distance trains arriving at Berlin, which pass over the Urban Railway. Berlin has long grown beyond its Urban Railway and even burst the fetters imposed upon it by the Circle Railway; and suburban trains now run, like the radii of a circle, in various directions.



Berlin City and Circle Railway, with Connections.

The Berlin Urban Railway is an elevated or overhead railway, passing above the streets and other means of communication. The masonry of its vaulted

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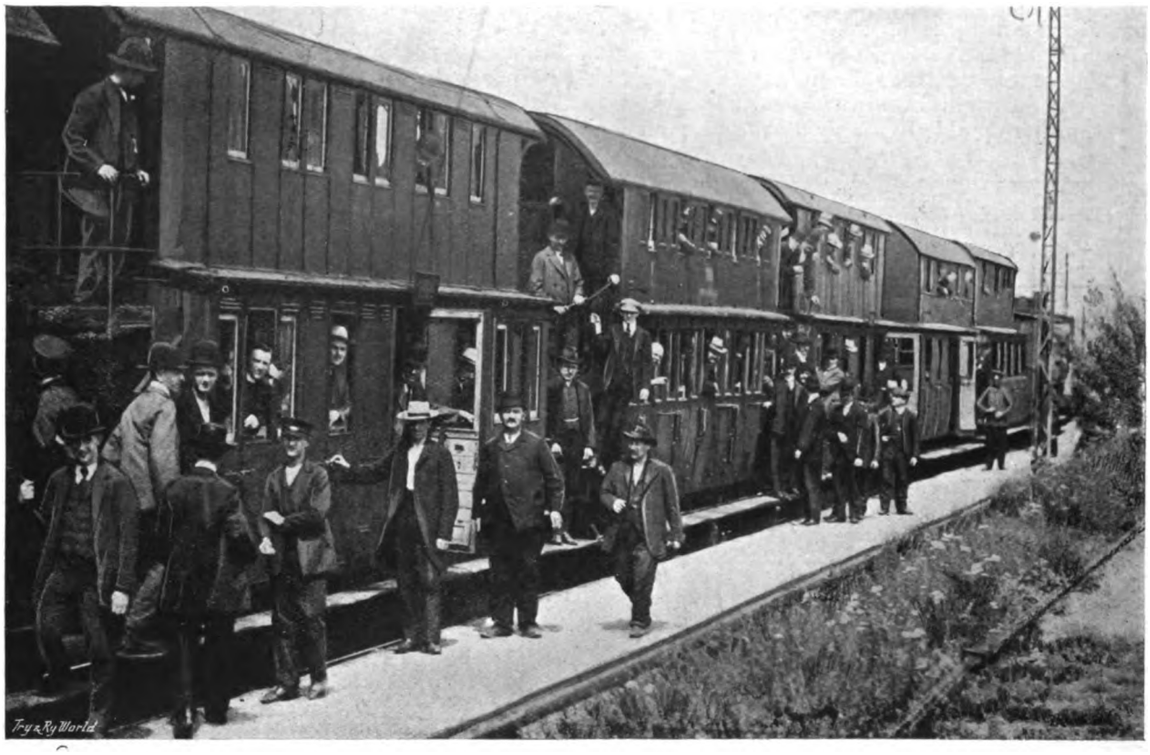
viaducts, with their high arches, extends right through the whole city and forms one of its characteristic features. There are practically everywhere four lines of rails. The trains are drawn by tank locomotives, having three axles, double coupled and external valve gear; the fuel used is coke, to avoid the smoke nuisance. Trains are, as a rule, composed of nine carriages (three being second class and six third class). The passenger cars are, like those of the German State Railways, divided into small compartments. The passengers themselves have to open and close the doors, and no names of stations are called out. Within the short time allowed for stopping, the passenger must, without asking questions or receiving information, unassisted find his place in the train and rapidly alight on arriving at the station of his destination. The Berlin public have been so well trained that traffic is carried on rapidly and smoothly. Traffic on the Urban and Circle Railways begins as early as four o'clock in the morning and lasts till one o'clock at night. Trains are run at intervals of two or three minutes. The fare from any station to the next fifth station (inclusive of it) is 10 pfennig (one and a fifth penny) third class and 15 pfennig second. For longer runs the fares are 20 and 30 pfennig respectively. Special reduced tickets are issued to workmen. No other large city in the world can boast of such cheap fares on its urban and suburban railways. The receipts (as in the case of the London Metropolitan District Railway) are far from sufficient to pay a fair rate of interest on the initial capital, after defraying working expenses, although approximately a million people are carried daily by the Urban and Circle Railways. What increasing traffic requirements have to be reckoned with in future is shown by the increase in the traffic experienced in the past. Traffic on the Urban and Circle Railways has increased from 75 million journeys in 1895 to 157 million in 1909. At present it is increasing at the rate of about seven millions every year. Suburban traffic has more than trebled within the last 14 years. With such increases in the traffic, the capacity of the railway is even now taxed beyond its limits. The trains, although they have been multiplied and lengthened as much as is possible, are at times unpleasantly overcrowded.



Double-Deck Railway Cars for Berlin Workmen.

ELECTRIC TRACTION.

For a long time the Railway Administration has been giving its earnest attention to the question how the carrying capacity could be enlarged, and it has now been decided to introduce electric trains in 1916. With the present steam trains the utmost that can be done is to run over the Urban Railway 24 trains per hour, each consisting of 488 seats, an aggregate of 11,712 seats. In order still to carry on the traffic under satisfactory conditions, in 1916 at least 30 trains will have to be run in each direction, each affording 610 seats, or in all 18,300 seats. By adopting electric trains it will, however, be possible to run about 40 trains per hour.

In the meantime, the other means of communication are also undergoing considerable extensions. Several new lines are being added to the underground railways in particular. It was at the Berlin Exhibition, as is well known, that Werner von Siemens demonstrated in 1879 the first experimental electric railway. Twenty-two years later the firm of Siemens and Halske, Berlin, was authorised to build an electric elevated and underground railway, 11 kilometres long, right across the capital from the Zoological Gardens to the Warsaw Bridge, with a branch to the Leipziger Platz. In the same year, the Elevated Railway Company was established under the guidance of the German Bank, its object being to build, in co-operation with the firm of Siemens and Halske, the main line and its future extensions. The concession does not expire until 1987.

THE ELECTRIC OVERHEAD RAILWAY.

The Elevated Railway Company now owns and works about 11·16 miles of high-speed railways, one-half being elevated and the other underground. The

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journey from the woodlands of the West End to the City (6·84 miles) is performed in 25 minutes, and to the east of the town (8·06 miles) in 30 minutes. To enlarge its present system the company intends to build five new connecting lines, of which two are to be opened for traffic in 1913. After the completion of all its sections, the network worked on a uniform system by the Elevated Railway Company will have a length of 27·28 miles, and consist of two large diagonal lines, having in common the central section (with Wittenbergplatz as joint station), and with several branches at their ends. The Elevated Railway is principally carried on iron viaducts, following the central line of of the streets. The architecture of its stations and viaducts is brought into line with the general character of the streets and squares. The platforms are about 21½ ft. above the ground. On account of the high underground water level the Underground Railway has been built at a small depth below the street pavement, and made proof against irruption of water. The platforms lie about 13 ft. below the street level. As a rule, straight and wide streets could be adapted as the route of this railway. In the city, however, certain sections had to be constructed under narrow streets and frequently under houses. An interesting transformation has only recently been completed at the reversing triangle of the junction station. The old reversing triangle, where three different traffic streams crossed one another, was a celebrated masterpiece of railway engineering. The frightful disaster, which took place at this spot four years ago—when one carriage fell into the street, and about 20 passengers were killed—gave rise to the reconstruction of this triangle. This has been carried out in such a way, that instead of three traffic directions, there are now only two, viz., the direction from the west to the City and the direction from the east to the reversing triangle and *vice versa*. For this purpose two stations have been built one above the other, intersecting at about a right angle. The two stations are connected with each other by a staircase giving means of communication for passengers changing from one line to the other.

The rolling stock of the Elevated Railway Company consists of 139 carriages and 112 trailers, in all 251 vehicles. Every carriage has four axles. They are wide and convenient and provided with sliding doors. Two different classes are run on the trains. Until a short time ago smoking carriages were provided, but these have now been discontinued for practical traffic reasons. Trains consist mostly of four to five carriages. The maximum speed is 31 miles per hour. The shortest interval between trains is at present two minutes. In 1911, 63·5 million passengers were carried by the Elevated Railway Company. In the inferior class the fare is 10 pfennig for five stations, and another 5 pfennig for every three additional stations. The extra charge for the superior class is 5 pfennig in the former and 10 pfennig in the latter case.

The system of the Elevated Railway Company communicates in the south-west with the Wilmersdorf and Schoeneberg Underground Railways. As the existing lines, the same as the Urban and Circle Railways, mainly extend in the west to east direction, the connecting links required to complete the system are, above all, north to south connections. A line is now under construction which, following the line of the Friedrichstrasse, is to run from the extreme north and, passing under the recently-built quarter in the Tempelhofer Feld, will extend as far as Tempelhof and Neucöln. It is the intention of the city of Berlin to build this line on its own account. But of perhaps even greater importance than this line would be, for the economic life of Greater Berlin, the creation of improved means of communication from Gesundbrunnen *via* Alexanderplatz to Neucöln. Approximately one million people, nearly one-third of the total population, reside at a distance of one kilometre from the stopping places of the High-speed Railway Line. A suspended railway scheme of the Continental Company for Electric Enterprises is

Station of Overhead Electric Railway at Nollendorf Platz.

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here competing, in order to secure the new line, against the elevated and underground railway scheme of the General Electrical Company.

TRAMWAYS AND MOTOR OMNIBUSES.

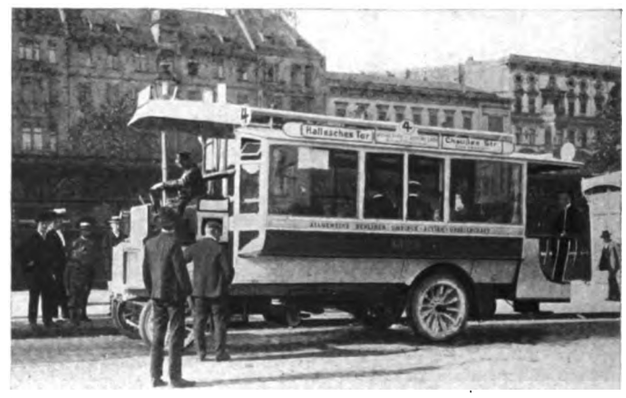
Owing to the creation of an extensive high-speed railway system the means of communication in the streets themselves had to be brought into line with this high-speed system. The Great Berlin Street Railway Company, by which nearly the whole of the Berlin street railway traffic is carried on, is ever anxious to extend the sphere of its operations. The total length of track worked by this company has been

Overhead Electric Railway Penetrating Building.

increased from 300 miles in 1902 to 330 miles in 1911. For many years there was war between the Great Berlin Street Railway Company and the city of Berlin, but the points in dispute were definitely settled in 1911. The city gave its consent to the company making use of the streets until December 31, 1939. On the other hand, the company is bound, at the city's option, either to surrender in favour of the city the concession obtained from the State, as from January 1, 1940, or to continue its exploitation. The city has, moreover, the right to acquire the concern as a whole on January 1, 1920, 1930, 1935, or 1940. The purchase price it would have to pay is the average dividend during the last seven years multiplied by 25. If the city should not make use of its right of acquisition, on the determination of the contract relations on December 31, 1939, the total permanent way, landed properties, means of exploitation and other movables used for the exploitation would vest in the city. The compensation paid, once for all, by the company to the city for all the rights secured to the company under its contract has been the sum of 23,000,000 marks. The company has obtained further protection against competitive lines by the grant of additional valuable concessions and rights of co-utilisation. The company's network comprises the whole of the city and nearly the whole suburbs. Service is given on 117 lines running in all directions from an early hour in the morning until late at night. Each car carries in front and at the rear a route sign in plainly legible figures or letters. The uniform fare for all sections, for the longest of which—the outer ring—the journey takes nearly two hours, is 10 pfennig. Only for suburban traffic are higher fares charged. No transfer tickets are issued. A few figures will give an idea of the magnitude of its traffic. The number of car journeys performed in 1911 was 8,505,574, and the number of kilometres run was 101,483,066. The number of passengers carried amounted, on an average, to 447,000,000, and 2,737 cars were in service. Working receipts amounted in 1911 to 43,484,055 marks, working expenses were 23,912,378 marks, giving a profit of 19,571,676 marks. In addition to the network of the Great Berlin Street Railway there are six lines worked by the Berlin Street Railway Joint Stock Company, which is a municipal concern, and several lines are worked by the suburban communities.

A very popular means of communication is the Berlin omnibus, which enjoys the patronage of the whole population. A considerable share in local communications of Greater Berlin is contributed, not only by the motor omnibus, but even by the old-fashioned horse omnibus. Its advantage over electric tramways is this, that whenever, owing to some current interruption or obstruction of traffic, an endless succession of electric cars is held up and unable to budge, the 'bus serenely proceeds on its journey. It has no fixed stopping places, but stops whenever a passenger wishes to get on or off. Besides, the horse 'bus is cheaper than the street railway. The fare for a divided section is only 5 Pf., for the whole section 10 Pf. The vehicles of the Berlin General Omnibus Joint Stock Company pass through the most frequented streets of the capital. At the end of 1911, 25 lines were worked by 470 horse omnibuses. The average number of horses was 4,865. By way of experiment a few mules have also been recently introduced, in order to ascertain whether better economic results can be obtained from them than from horses. These experiments have not yet been conclusive. Some horse omnibuses are drawn by one horse, others by two. In 1911 the number of passengers conveyed by horse omnibuses amounted to 111,241,651 persons.

The horse omnibus is gradually being supplanted by the motor omnibus. Motor omnibus traffic is carried on on eight lines, of which the most important line extends from the Hallesche Tor through the whole length of the Friedrichstrasse to the northern part of Wedding. The 96 motor vehicles of the omnibus company carried in 1911, 41,590,051 persons. The cars have outside seats. The company has its own workshops, where the



Berlin Single-Deck Motor Omnibus.

spare parts required for frequent repairs are made. The total number of passengers conveyed by omnibuses in 1911 was 152,832,602. The fares collected amounted to the sum of 11,184,335 marks. The last dividend the company has been able to distribute is 7 per cent. For excursions and tourists special motor cars "de luxe" are provided. On one of the western lines, traffic is kept up all through the night; otherwise, late night traffic is the province of the Berlin Omnibus Company, whose green cars are so familiar to the nightly frequenter of the Friedrichstadt.

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BERLIN'S TRAFFIC BOARD.

Within the last few years the capital of the German Government has become alive to the fact that certain measures will have to be taken to regulate in accordance with large, general, and uniform principles, further building operations of the gigantic city, and its sanitary, ornamental, and traffic requirements, so that an harmonious and convenient character may be bestowed on this rapidly increasing city. Much has already been achieved to realise this object. Suburban communities have been incorporated with Berlin itself into a Greater Berlin, and prizes were offered to obtain a suitable building scheme for Greater Berlin. Architects, engineers, and traffic experts have contributed their various shares towards the solution of this great problem. A number of schemes were awarded prizes and publicly exhibited three years ago at the Berlin Municipal Building Exhibition. This exhibition gave rise to the creation of an organisation by which the problems of town building and traffic are considered.

The Greater Berlin General Purposes Board (Zweckverband Gross-Berlin) was established by law in June, 1911. It has for its task to provide ample means of communication, to ensure the preservation of woods and open spaces, and to promote colonisation. It is designed to prevent the suburban communities from pursuing an interested policy of their own, without regard to the general community. The General Purposes Board is, therefore, to form a competent authority for town-planning and traffic questions, thus curtailing the power of individual communities.

Greater Berlin has grown up haphazard and without any uniform plan. The building plans of the individual quarters and suburbs were frequently drawn up without regard to their neighbours. The railways lie wedged in between masses of houses, incapable of any enlargement, and prove over long distances an obstacle to all cross traffic. At present there is a lack of large and straight street lines. No sufficient distinction is drawn between streets used for traffic and those used for residential purposes. All competent persons and bodies are agreed that the open country surrounding Berlin must be less compactly built on. In 1880, the population of Berlin was just over a million. Within 25 years, two millions have been added to it. The area occupied by them has been built over to a very large extent, and additional millions will find no accommodation within the areas hitherto built on. On the outskirts alone can they take up their residence. Of space there is plenty, but the distance of these future colonisation areas from the business quarters is even now so considerable that street connections and street railway connections are found insufficient. If these outer districts are, therefore, to be colonised, they must be opened up by high-speed railways, which will have to be built independently of roadway surfaces. In the various larger cities of the world it can be distinctly seen that their development takes place along the suburban railways. It is true that at Berlin the question of opening up the surrounding country areas has not yet become particularly urgent, because the nine million people who are to be settled there do not yet exist. What is far more keenly felt at present by the Berlin population is the lack of urban high-speed railways. Any reasonable further development of the town, any suitable settlement of future population, would be impossible without further developing in the right manner the inner and outer railway systems. To see to this is the first and foremost task of the Greater Berlin General Purposes Board.

In the Greater Berlin General Purposes Board the municipal community of Berlin, with its 15 suburban communities and two rural districts, is formed into one Communal Board of Supervision. The Board has the right within the district governed by it to acquire, build, and work railways and use the roads required for this purpose, paying compensation for them. The districts and communities within the area governed by the Board are bound to transfer to the Board on its demand the property in any railways belonging to them, together with all the rights and obligations connected therewith, against suitable compensation. Before building new railways, the districts and communities have to obtain the consent of the Board. The Board may, for parts of the area covered by it, fix general lines of direction for building purposes, as far as may be deemed necessary for the building and development of streets, construction of railways, or preservation of open spaces. It may also decide on the acquisition of considerable areas that are not to be built on, such as forests, parks, meadows, lakes, ornamental spaces, playgrounds, etc. It is authorised to collect dues and contributions from districts and communities. The organs of the Board are its Assembly, its Committee, and its Manager.

The Assembly of the Board is composed of the first mayor of the City of Berlin, Dr. Adolf Wermuth, as chairman, and 100 representatives elected by the communities according to the size of their population. The municipal community of Berlin itself is, in addition to its first mayor, represented by 40 members. Representatives are elected for six years by the Representations of Communities, in towns, with the co-operation of the Municipal Council. For each member a deputy is elected, who is competent to act for the member in cases where the member is unable to be present. The Committee of the Board is composed of the first mayor of the city of Berlin, as chairman, one member of the Berlin Municipal Council, and six mayors of the communities next in order of population, the chairman of the District Committee, and eight other members. The Board Committee passes resolutions on all matters of the Board which have been prepared by the Board Assembly. It is, therefore, strictly speaking, the executive organ of the Board. The manager of the Board conducts the current business of the Board Committee. The manager is the superior of all the officials of the Board, and represents the Board externally in all matters. The present manager of the Board is Dr. Steiniger, an official who has had great experience in communal matters. An expert adviser on traffic questions, Professor Erich Giese, who is regarded as the leading authority on Berlin traffic matters and a traffic expert of tested ability, is attached to his staff. In his former capacity of chief constructional engineer of the Berlin Railway Administration Dr. Steiniger was in charge of the construction of the first Berlin underground railway. On building questions the manager of the Board is advised by Mr. Kiehl, municipal counsellor of building and architect of the General Purposes Board. The General Purposes Board entered upon its functions on April 1, 1912, and has already given proof of being a body well fitted for its purpose.

Bradford Early Morning Halfpenny Fares.—The report published in our issue of January 9 of the meeting at which the Tramways Committee received the half-yearly financial statement, mentioned that the decrease in revenue on account of the introduction of halfpenny fares up to 9 a.m. had not proved so large as the general manager, Mr. C. J. Spencer, originally estimated it would be. Later information shows, however, that Mr. Spencer's estimate was singularly accurate. In fact the loss was, actually, a little more than the estimate. That the general manager's forecast of the result was so exact incidentally affords proof of the thorough grasp which the tramway department has of the conditions of the traffic and the requirements of the public

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TRAFFIC RETURNS—*continued.*

TRAMWAYS AND OMNIBUSES.	1911. WEEKS ENDING.					1912. WEEKS ENDING.					AGGREGATE.		
	Dec. 1.	Dec. 8.	Dec. 15.	Dec. 22.	Dec. 29.	Nov. 30.	Dec. 7.	Dec. 14.	Dec. 21.	Dec. 28.	Wks.	1912.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Burnley Corporation	1.341	1.302	1.354	1.519	1.576	1.446	1.423	1.553	1.547	1.762	39	59.350	+ 4.682
Burton-on-Trent Corporation ...	253	254	261	346	273	258	255	271	276	323	39	10.699	- 464
Bury Corporation	1.120	1.131	1.146	1.255	1.382	1.158	1.229	1.225	1.244	1.409	43	50.904	- 57
Cardiff Corporation	2.238	2.217	2.350	2.686	2.348	2.331	2.343	2.519	2.577	2.735	39	96.086	- 807
Chatham and District	728	760	757	852	961	812	759	817	847	977	52	44.506	+ 156
Chesterfield Corporation	214	227	219	227	284	231	230	237	238	300	39	8.892	- 66
Colne and Trawden	233	228	222	246	268	231	236	253	244	286	52	13.393	+ 521
Cork Electric	413	454	443	491	510	444	420	449	463	537	52	24.940	- 937
Croydon Corporation	1.524	1.632	1.605	1.845	...	1.636	1.619	1.706	1.720	...	38	68.580	- 549
Darlington Corporation	207	207	213	249	231	227	217	221	236	264	39	8.847	+ 145
Derby Corporation	815	852	822	1.019	949	819	860	878	948	1.060	39	34.878	- 1.200
Dover Corporation	182	186	189	238	204	188	186	189	206	222	39	9.693	- 592
Dublin and Lucan	107	109	105	131	183	102	112	109	116	253	26	3.845	- 28
Dublin United	5.173	5.403	5.259	6.052	5.535	5.317	5.249	5.576	5.812	6.142	26	150.158	- 7.275
Dundee City	1.141	1.092	1.186	1.194	1.479	1.124	1.143	1.186	1.283	1.419	33	40.390	+ 980
East Ham Corporation	1.027	1.061	1.044	1.187	1.156	1.025	1.019	1.051	1.075	1.259	39	42.182	- 866
Exeter Corporation	260	270	304	321	365	269	265	291	295	355	39	12.892	- 778
Glasgow Corporation	19.010	18.871	17.583	18.545	18.742	18.393	18.581	19.317	19.319	20.021	39	569.293	- 6.000
Glossop (Urban Elec. Supply Co.)...	117	115	123	130	136	119	120	128	129	140	52	6.135	- 329
Halifax Corporation	1.657	1.713	1.610	1.746	2.247	1.818	1.707	1.838	1.816	2.160	38½	78.732	+ 1.164
Hastings and District	694	678	694	752	1.040	710	659	684	712	904	52	49.407	- 2.585
Huddersfield Corporation	1.877	1.767	1.849	2.062	2.176	1.953	1.933	2.014	2.077	2.483	41	78.861	+ 2.140
Hull Corporation	2.885	2.974	2.999	3.464	3.265	3.027	3.002	3.100	3.208	3.473	39	116.707	+ 1.625
Ilford U.D. Council	457	343	466	561	559	392	402	417	442	537	39	18.739	- 2.455
Ilkeston Corporation	120	119	123	135	119	109	112	113	121	123	40	4.529	- 781
Ipswich Corporation	325	343	390	438	418	355	346	370	421	473	39	17.628	- 80
Isle of Thanet	244	255	268	304	357	268	263	276	292	356	13	4.273	- 124
Keighley Corporation	123	...	...	...	...	157	...	...	...	...	—	...	—
Kilmarnock Corporation	155	145	150	154	166	147	145	159	155	167	32	5.314	- 150
Lanarkshire	1.451	1.417	1.377	1.384	1.449	1.496	1.425	1.531	1.508	1.566	52	76.676	+ 2.012
Lancashire United	1.217	1.246	1.260	1.236	1.517	1.306	1.238	1.293	1.321	1.509	52	70.096	+ 361
Leeds City	7.048	7.341	7.298	7.926	8.026	7.432	7.499	7.752	8.009	8.758	39	306.005	+ 10.870
Leicester Corporation	2.408	2.520	2.499	2.929	2.782	2.605	2.670	2.674	2.768	3.113	52	133.926	+ 4.652
Leith Corporation...	583	552	577	604	627	600	589	619	611	675	32½	22.091	+ 660
Liverpool Corporation	11.282	11.593	11.957	13.700	12.052	11.851	11.947	12.618	13.208	13.258	52	625.164	+ 26.978
Llandudno and Colwyn Bay ...	103	135	116	134	186	160	101	133	136	207	4	577	+ 6
London County Council	41.316	42.785	41.971	44.985	45.862	41.091	40.069	41.904	42.618	45.036	39	1.622.413	- 80.642
London General Omnibus... ...	37.210	38.151	39.059	41.430	35.401	54.147	55.107	57.308	60.392	52.607	13	719.225	+230.135
London United	5.210	5.456	5.239	6.030	6.345	5.290	5.296	5.540	5.731	6.718	52	322.156	- 13.166
Lowestoft Corporation	150	152	177	200	165	163	154	177	176	187	12	2.246	- 15
Maidstone Corporation	...	140	138	151	202	...	146	157	156	224	39	7.593	+ 308
Manchester Corporation	15.632	15.903	16.127	17.573	16.195	16.368	16.455	17.084	17.765	17.278	39	657.856	+ 23.277
National Steam Car	4.728	...	...	...	5.082	8.373	...	...	...	8.584	9	16.957	+ 7.147
Nelson Corporation	162	163	171	198	206	194	173	194	184	214	39½	7.770	+ 481
Newcastle-on-Tyne Corporation ...	4.236	4.166	4.324	4.820	4.456	4.409	4.519	5.080	4.821	5.055	39	174.241	+ 4.841
Newport (Mon.) Corporation ...	665	652	675	790	726	692	678	751	727	863	39	27.826	- 146
New St. Helens and District ...	626	646	694	671	898	696	664	713	704	846	26	19.607	+ 322
Northampton Corporation... ...	449	474	465	557	650	506	465	492	504	654	38½	21.148	- 36
Nottingham Corporation	2.898	3.047	3.003	3.080	3.324	3.152	3.042	3.182	3.132	3.286	39	123.923	+ 1.666
Oldham Corporation	1.851	1.830	1.906	2.064	2.086	1.838	1.955	1.979	2.045	2.276	40	82.384	+ 4.862
Portsmouth Corporation	1.616	1.658	1.669	1.970	1.721	1.604	1.647	1.755	1.877	1.768	39	84.017	- 4.698
Preston Corporation	691	728	712	756	968	758	740	768	799	927	39	32.413	+ 1.433
Provincial...	1.422	1.451	1.498	1.771	1.714	1.457	1.512	1.602	1.723	1.815	13	20.879	+ 1.037
Reading Corporation	558	580	617	677	789	613	571	648	648	791	38½	25.144	- 259
Rochdale Corporation	1.262	1.283	1.335	1.459	1.557	1.383	1.382	1.451	1.506	1.735	39	60.374	+ 4.972
Rotherham Corporation	645	678	661	708	911	860	818	878	870	1.008	38½	30.223	+ 3.498
Salford Corporation	4.667	4.722	4.769	5.120	5.162	4.681	4.958	5.022	4.181	4.874	39	196.281	+ 3.668
Sheffield Corporation	6.513	6.485	6.666	7.296	7.499	6.798	7.103	7.226	7.242	8.290	39	270.958	+ 12.519
Southampton Corporation... ...	1.029	1.107	1.055	1.211	1.255	1.085	1.048	1.117	1.143	1.251	38	48.321	- 124
Southend-on-Sea Corporation ...	421	452	422	510	519	548	514	535	560	609	38	31.325	+ 3.396
South Shields Corporation ...	566	577	587	661	662	570	582	641	624	752	39	25.017	+ 387
Sunderland Corporation	1.203	1.215	1.249	1.395	1.320	1.193	1.265	1.256	1.363	1.560	39	51.350	- 1.107
Swindon Corporation	134	149	148	161	216	144	134	152	154	192	38½	6.073	- 287
Tyneside Tramways and Tramroads	418	436	420	431	509	445	416	638	552	541	26	12.932	- 208
Wallasey Corporation	942	1.009	985	1.132	1.039	987	967	1.026	1.077	1.077	38	43.611	- 219
Walsall Corporation	556	566	566	663	739	582	585	611	619	849	52	30.402	+ 900
Walthamstow U.D. Council ...	617	617	615	719	785	631	638	664	690	847	39	28.494	- 1.104
Warrington Corporation	381	401	418	437	498	438	431	455	456	523	39	16.844	+ 1.149
West Ham Corporation	2.582	2.630	2.575	2.849	3.008	2.493	2.458	2.558	2.692	3.040	38½	101.904	- 3.997
Wigan Corporation	1.233	1.281	1.318	1.341	1.519	1.354	1.311	1.391	1.438	1.625	38½	52.184	+ 1.999
Wolverhampton Corporation ...	951	938	944	1.267	1.036	976	1.045	1.031	1.129	1.306	40	41.106	+ 1.439
Yorkshire (West Riding)	1.176	1.121	1.168	1.315	1.572	1.191	1.254	1.257	1.340	1.837	52	67.997	+ 1.707
FOREIGN TRAMWAYS.													
Anglo-Argentine	52.569	49.922	52.140	53.175	57.767	54.552	59.056	56.863	57.159	64.790	52	2.708.166	+141.496
Auckland ... ... (28 days)	16.594	...	...	...	...	19.174	...	...	...	...	21	97.203	+ 15.752
Bombay ... ... Rs.	4.079	4.711	...	...	...	3.180	3.290	...	...	...	49	1.49.233	+ 3.394
Brazilian Street ... (month) Mlrs.	38.382	...	...	...	...	44.278	...	...	...	...	17	171.342	- 1.529
Brazilian Traction ... ...(month)	...	...	...	...	...	364.443	...	...	...	...	13	1.075.707	—
Brisbane ... ...(month)	21.890	...	...	...	...	24.310	...	...	...	...	48	228.421	+ 551
British Columbia ... (month) $	488.699	...	...	...	...	591.127	...	...	...	...	22	2.822.812	+544.421
Buenos Aires Port and City (month)	6.004	...	...	...	...	6.034	...	...	...	...	48	67.849	+ 6.106
Buenos Ayres Lacroze ...(month)	41.356	..	...	...	...	44.773	...	...	...	...	22	216.831	+ 29.087
Calcutta ... ... Rs.	59.086	56.720	57.520	61.924	78.056	66.550	65.796	64.890	62.610	66.164	52	32.10.793	+2.16.127
Cape Town ... ...(month)	10.736	...	...	...	...	11.267	...	...	...	...	21	54.593	+ 3.085
Carthagena and Herrerias (month)	1.409	...	...	...	1.888	1.703	...	...	...	3.001	52	26.346	- 1.331
East India ... ...(month)	1.429	...	...	...	...	1.924	...	...	...	...	17	7.688	+ 1.980
Kalgoorlie ... ...(month)	3.165	..	...	...	...	2.861	...	...	...	...	48	34.604	- 3.340
La Plata ... ...(month)	4.446	..	...	...	...	5.210	...	...	...	...	48	46.314	+ 1.923
Lima ... ...(month)	30.297	...	...	...	...	30.700	...	...	...	...	48	339.166	- 2.348
Madras ... ... Rs.	20.653	(2 weeks)	22.730	(2 weeks)	24.709	21.902	(2 weeks)	23.821	(2 weeks)	29.482	52	5.98.083	+ 63.983
Melbourne ... ...(month)	63.500	...	...	...	...	66.000	...	...	...	...	48	612.500	+ 58.500
Mexico ... ... (month) $	521.421	...	...	...	...	565.239	...	...	...	...	48	6.159.944	+548.603
Montevideo ... ...(month)	26.614	...	...	...	...	29.623	...	...	...	...	4	29.623	+ 3.009
Para	3.672	3.747	3.684	3.632	3.631	3.743	4.161	3.910	3.622	4.020	4	15.713	+ 1.019
Perth (W.A.)	1.704	1.740	1.809	2.008	2.421	1.958	2.025	2.131	2.216	2.625	52	98.779	+ 13.877
Port Elizabeth ... ...(month)	2.953	...	...	...	...	3.216	...	...	...	...	21	15.577	+ 1.208
Shanghai ... ... $	17.834	18.419	17.283	19.314	16.816	20.600	20.200	20.200	18.600	19.200	52	1.020.260	+230.116
Singapore ... ... $	9.982	10.409	9.992	9.430	9.192	10.031	10.478	10.435	10.380	10.266	52	541.048	+ 10.697
Toronto ... ... (month) $	676.791	...	...	...	...	742.156	...	...	...	...	48	7.717.303	+828.515
Winnipeg ... ... (month) $	355.825	...	...	...	...	345.091	...	...	...	...	48	3.403.683	-106.165
ELECTRIC RAILWAYS.													
Central London	5.222	5.517	5.440	5.795	3.778	5.889	5.624	5.795	5.969	4.407	26	129.061	+ 4.924
City and South London	3.305	3.702	3.338	3.886	3.808	3.090	3.075	3.204	3.298	3.512	26	77.506	- 6.976
Great Northern and City	1.708	1.716	1.692	1.717	1.589	1.503	1.497	1.482	1.475	1.267	26	36.683	- 1.648
Liverpool Overhead	1.420	1.422	1.544	1.641	1.333	1.545	1.587	1.595	1.628	1.500	26	42.380	+ 3.379
London Electric	14.380	15.080	14.765	15.355	13.355	14.985	14.480	14.890	14.975	13.460	26	344.640	+ 24.178
Mersey	2.145	2.186	2.288	2.606	2.193	2.282	2.351	2.370	2.647	2.491	26	57.014	+ 5.287
Metropolitan	17.966	18.668	18.457	19.326	17.701	18.145	18.340	18.466	18.700	18.402	26	447.583	+ 5.354
Metropolitan District	12.326	12.356	12.506	12.986	11.686	13.767	12.763	13.052	13.112	12.214	26	326.157	+ 24.178

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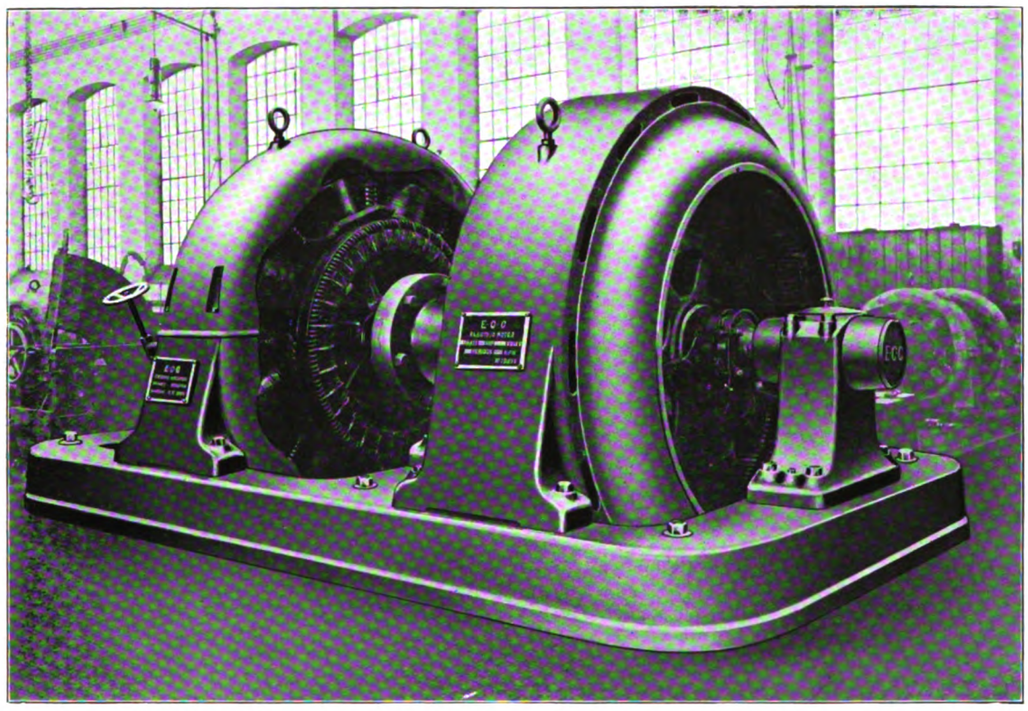
AND
SWITCHGEAR

OF EVERY DESCRIPTION.



600 KW. SYNCHRONOUS MOTOR-GENERATOR.

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TELEGRAMS—"Concordance," London.

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TELEPHONES—75 and 430 Wolverhampton.
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"THE COVENTRY"
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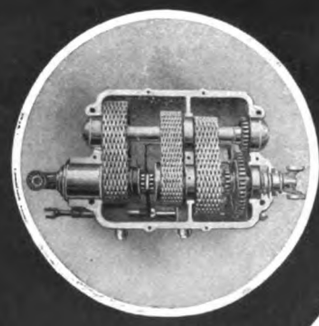

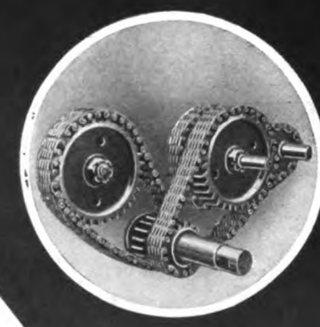

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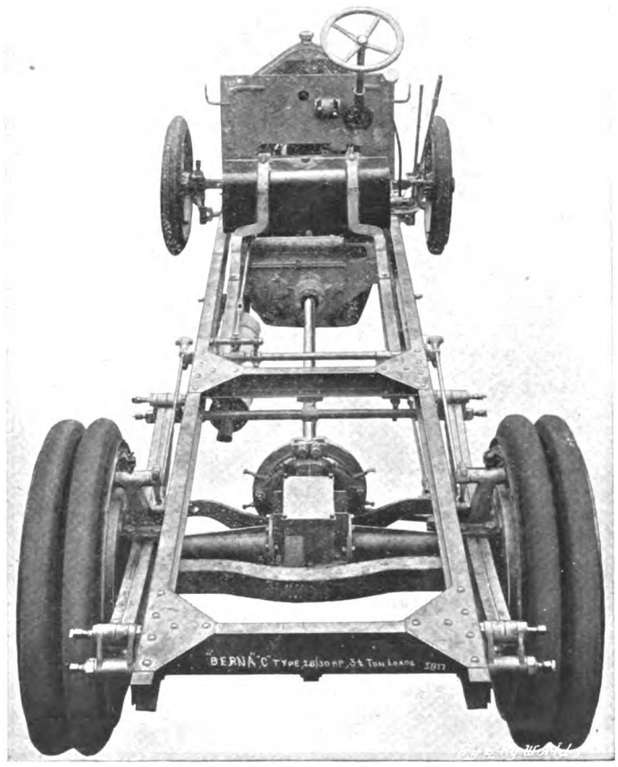

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TOWER WAGONS,
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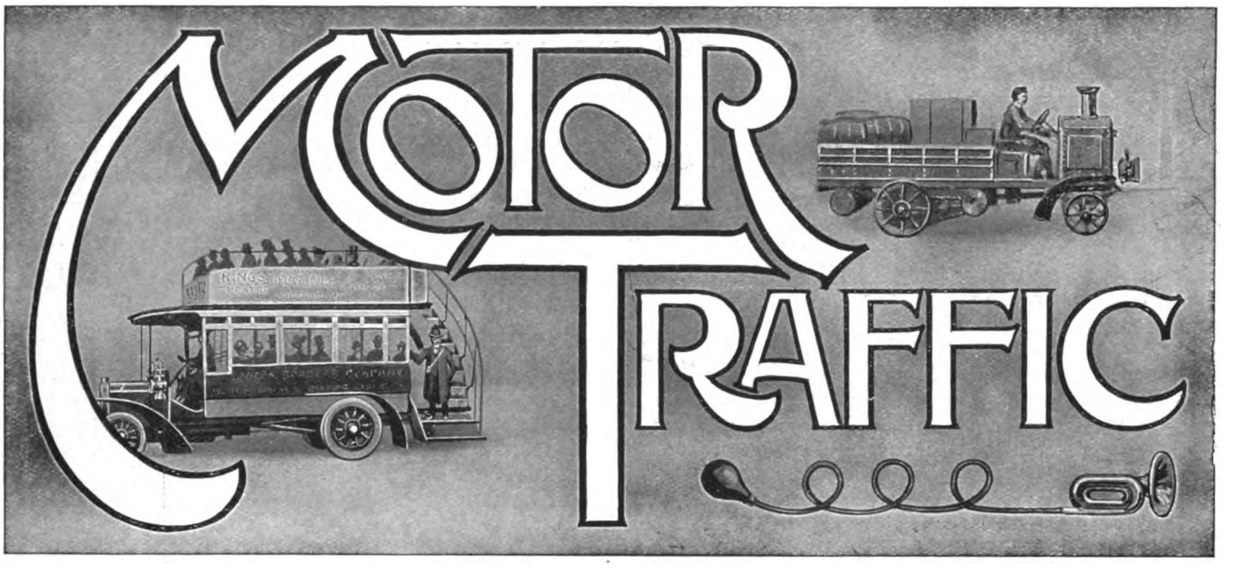

The fuel question continues to be the all-absorbing topic of interest with the users of industrial motor vehicles. Owners now fully realise that for a variety of reasons little, if any, reduction in the price of petrol can be expected while the demand for the spirit is maintained in anything like its present volume, and its supply is regulated in the manner which at present obtains. During a recent conversation with a well-known authority on the importation and distribution of petrol, we were assured that the present high prices are due not only to the extraordinary demand which has sprung up within the last year or two, but to the cost of freightage and the expense of distributing the spirit. Under these circumstances it is obvious that the steps that are being taken to produce an efficient home-made substitute is the only remedy that is likely to relieve a situation which, if allowed to continue, will have a most serious effect upon the motor industry. During the past month a number of trials of more or less importance have been carried out with a variety of fuels, and of these the best results have been obtained with a benzol mixture —90 per cent. pure benzol with 10 per cent. toluol. This mixture not only gives a better mileage than pure benzol, but the presence of the heavier liquid reduces the freezing point to a very considerable extent, so that from that point of view 90 per cent. of benzol becomes a most suitable fuel for use in all parts of the United Kingdom.

The efficiency of the new fuel is approximately 5 per cent. higher than petrol, while the present price compares most favourably, ranging from 9d. to 1s. per gallon according to quantities. In practice 90 per cent. benzol, as the fuel is commercially known, appears to be quite as satisfactory as petrol. Moreover, the odour from the exhaust while distinctive is far from unpleasant. Benzol is a by-product obtained in varying degrees of purity from gasworks and other coke-making plants, and it is largely used at present in the manufacture of aniline dyes, although it has been used to some extent as a motor fuel on the Continent. The principal point of interest at the moment is the question of supply. Taking the entire output of the present coking plants in the United Kingdom it is estimated that less than 25 per cent. of the quantity required by motor vehicles alone would be forthcoming. Naturally a number of additional plants will be installed directly the demand is apparent, and in view of the wide possibilities opened up by the satisfactory nature of the recent experiments it is reasonable to suppose that special attention will now be given to the production of the spirit on a thoroughly commercial basis. The Society of Motor Manufacturers and Traders, who have voted the sum of 2,000 guineas to the proposed fuel trials by the Royal Automobile Club, have suggested to the club that a special committee be formed to deal with the benzol question. At their meeting in December the Club Committee stated that the matter was to be discussed at the next meeting of the Petrol Committee, and it was therefore decided to defer consideration until after that meeting, a decision which was approved by Mr. E. Manville, president of the society. At present benzol, like paraffin, does not bear the Excise duty of 3d. per gallon imposed on petrol for the supply of funds to the Road Board, but there is reason to believe that the taxation of alternative fuels is under consideration.

A saving of not more than one-sixteenth of a penny is estimated to be the amount which would revert to the public if the vessels now being built to carry 12,000 tons of spirit are allowed to come up to Purfleet to discharge, instead of being restricted to Thames Haven. This is the estimate of a special committee of the Port of London Authority, which had the assistance in their inquiry of Sir Boverton Redwood and Professor V. B. Laws, two experts who have taken part in the proceedings of the special committee which have sat at the Home Office to investigate matters connected with the transport of petrol. Since the representatives of the oil companies, who gave evidence before the Petrol Committee, were firm in declaring that if they could prevent it there would be no lowering of the price of petrol, the smallness of the estimated reduction will occasion no surprise. The Port of London Authority's inquiry was carried out in consequence of suggestions made during the late strike in the London Docks, and in advising against allowing the tank steamers to unload beyond Thames Haven, the committee declare that the contrary course would be fraught with serious risk to shipping in the narrower parts of the river and to the industries situated on the river banks. The report, which has been adopted by the authority, recommends that tank barges carrying the spirit above Thames Haven should be increased in size. Motor users in the Midlands and the North may in the course of a year or two look for a slight reduction in the price of petrol, on account of the passage this session of a bill to permit of the

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MOTOR TRAFFIC.

construction of a pier at North Killingholme, on the Humber, where the Admiralty are also providing oil storage.

At one time the dominant tone adopted by the oil companies' delegates before the Petrol Committee seemed likely to arouse motorists to action. Apparently the Automobile Association and Motor Union have abandoned their plan for obtaining cheaper petrol for their members, and the "Motor Owners' Petrol Combine, Limited, in formation," seems to have rested content in announcing, early in November last, that "the preliminaries have given them access to 60,000 motorists, and that owing to the state of the market it has been decided to defer the issue of capital of £1,140,000," wherewith to provide "producing oil wells, tanks, steamers, road and railway stock, distributing depots in chief dock centres and inland towns, and a refinery in England."

The partial failure of the business side of British Army administration was demonstrated by the report of the Commission which sat at the close of the Boer war, and thus far there has been no test of the reforms that were subsequently instituted. Very little seems to be known of the capabilities of the Mechanical Transport Committee, which has since been brought into existence to formulate, amongst other things, specifications for the construction of motor vehicles, in order that by payment of subsidies a sufficient number may be at the service of the country in time of war, and for manœuvres. During the past year only two manufacturers submitted lorries for the 30 cwt. and 3-ton vehicle tests, and a further trial is to take place on January 9, and 21 following days. Entries are also being taken for a trial to be held in July next. The result of the trial already decided was that one firm gained a certificate of the suitability of their vehicle. An article contributed to the "Royal Engineers' Journal" by Capt. R. K. Bagnall Wild sets forth reasons for the slowness of manufacturers in entering their products, and it is gratifying to find that he gives no expression to criticism of the competence of the committee. His first excuse is that the makers are fully occupied in producing their own standard types; secondly, heavy initial expense is entailed in constructing a new type; thirdly, the military specifications are more costly to build to; and fourthly, many of the War Office requirements are not needed by the purchasers of commercial lorries, thus rendering sales of the approved vehicle more difficult despite of the portion of the subsidy paid to the purchaser. Captain Wild's conclusions may be taken as well founded, for he was the first secretary of the Mechanical Transport Committee, and he has also acquired a knowledge of the commercial vehicle business. Amongst other activities he served for a number of years on the committee of the Commercial Motor Users' Association, acting as chairman of the annual parade of vehicles in London. That he is now engaged in the management of a firm manufacturing industrial vehicle is not to be regarded as rendering his opinions biassed; on the contrary, it increases the value of his views.

It is to be feared, however, that the suggestions which Captain Wild advances in the article referred to will not find acceptance, for the all-sufficient reason that in this country the Treasury cannot be induced to act in the thorough manner which marks the action of the State in matters military in Germany. The latter country, he mentions, grants a heavy subsidy to induce civil firms to adopt motor transport, hence the military authorities are able to ensure the adoption of their specifications, while at the same time heavy duties doubly protect the manufacturer against competition. Captain Wild's article, while setting forth the advantages of the German system, refers to all subsidy schemes so far in operation as failing to produce exactly the vehicle required, and as being more or less costly. What, then, is his alternative to the present scheme in this country, and to the power which the State possesses in time of emergency of commandeering private vehicles? Taking as his justification the existence of State enterprises such as the Post Office, and the telegraph and telephone systems, he advocates the institution of a State transport company at an estimated capital outlay of £1,400,000. Beneficial as such an organisation would prove in many ways to motor manufacturers and to users, the proposal might arouse great opposition, particularly from railway companies, even though the latter would stand to gain by its operation.

There can be no question that, given equal fares, a large section of the travelling public prefer the motor omnibus to the tramcar, so that where the two are in direct competition the motor vehicle is sure to get a fair share of the traffic, quite apart from the action of the driver and conductor. When, however, we take into consideration the fact that, with few exceptions, each driver and conductor in the employ of either of the motor omnibus companies operating in London is an active agent working in the interests of his shareholders, it is only reasonable to expect that the natural advantages of the more flexible system will be utilised in a manner eminently satisfactory to the proprietors of the undertaking. In the days of the horse omnibus the driver was a distinct asset of the company, both in regard to the skilful piloting of his vehicle at the points where traffic was to be obtained, and also on account of his geniality and ready wit. Although with the passing of the horsed vehicle this type of public servant has become extinct, the vacancy has been filled by men who, taken as a class, command the respect of all interested in the traffic problems of London, both on account of their skill and their devotion to duty. Despite the extraordinary demands which at times the exigencies of the traffic make upon them, the manner in which they assist their conductors to gather in every possible fare, can only be regarded as remarkable. By the manner in which the average conductor performs his duties it can be readily understood that the collection of fares is not regarded by him as the sole object of his existence — the convenience of the public is his first care, the rest following as a matter of course.

In comparison with the courteous attention which the public invariably receive at the hands of the motor omnibus staff, we fear that the methods of the tramway staff leave much to be desired. At a recent meeting of the Walthamstow Urban Council reference was made to a complaint which had been received with regard to the manner in which the tramway staff performed their duties. As the manager was requested

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MOTOR TRAFFIC.

to give the men some instruction as to their duty to the public, it would appear that the members of the Council considered the complaint more or less justified. At the same meeting the report of the Tramway Committee, recommending the reduction of fares in order to meet the omnibus competition, was also considered. The two reports, taken in conjunction, are certainly significant, and are capable of the inference that the one is to some extent in consequence of the other. Whether by reason of the fact that they are municipal employees, and therefore consider themselves not under the direct control of the management as in the case of the omnibus men, or have mistaken ideas as to their duty to the public, there is no gainsaying that far too many tramcar men as a rule do little or nothing to encourage traffic. On more than one occasion we have seen would-be passengers needlessly left behind at a stopping place, and afterwards picked up by a following motor 'bus. Judging from the automatic manner in which the average tramway man performs his duties, his work would appear to consist entirely of running the car between two given points as nearly as possible to a given time, and the collection of fares from the passengers who succeed in boarding the vehicle during the moments it is at rest. However satisfactory this system may have worked when the tramcar held the monopoly of the streets, in the face of the thoroughly efficient methods adopted by the omnibus staff, and the fact that all the best paying routes are now served with the improved type of motor vehicle, it is an easy matter to account for the preference which the public show for the motor omnibus and the consequent falling in the tramcar receipts.

WAR OFFICE MOTOR SUBSIDY TRIALS, 1913.

The Mechanical Transport Committee of the War Office are holding a further series of trials of petrol lorries to qualify as type vehicles suitable for earning the War Department subsidies, similar to those carried out in August last. The trials take place during January, on a route appointed by the War Department, and on January 24, at Aldershot. The latest date of entry was December 1. On a type of vehicle successfully passing the trials the manufacturer is granted a certificate under which suitable customers purchasing similar vehicles may have them enrolled and obtain the War Department subsidies.

RESULTS OF A TRIAL HELD IN 1912.

In some notes on the progress of the subsidy scheme during the present year the War Office Mechanical Transport Committee report that all the firms on the War Office list were invited to enter for trial a type vehicle built to specification, the distance comprising 1,500 miles, including long and difficult hills, the steepest gradient being 1 in 6. As a result of this first trial, held in August last, one Class A (to carry 3 tons) and one Class B lorry (to carry 30 cwts.), both manufactured by Leyland Motors, Limited, Leyland, Lancashire, were granted certificates by which exactly similar vehicles manufactured by the firm and sold to customers in this country may obtain subsidies amounting to £110 paid in half-yearly instalments. The fuel consumption on the larger vehicle for the 1,500 miles worked out at, approximately, 60 gross ton-miles per gallon, which with a vehicle weighing 7½ tons all told means eight miles to the gallon. The average speed was practically 12 miles per hour. Plans of other lorries have been passed, and but for unfortunate delays, caused by late delivery of materials, etc., type vehicles built to these designs would have been tested at the August trials. It is anticipated that some of these lorries will have passed their tests and received certificates before the end of the present year.

Advantage was taken of the trials to test the value from the military point of view of some types of motor omnibus which are to be found in large numbers on the London streets. Specimens were subjected to a certain number of days' trial along with the subsidy-type lorries, and some very valuable data were obtained as to their comparative wear, performance, and accessibility.

OMNIBUS ADVERTISING IN LONDON.

The directors of the London traffic combine are leaving nothing to chance. A liberal use of the morning, evening, and weekly newspapers is being made for display advertising of the motor omnibus services, which have penetrated every tramway route in London and many by-ways. Fortunes have been made in the business world through forceful advertising of sound goods, and it will be interesting to observe the measure of success achieved by publicity when used as a weapon for competing with tramways. A noble member of the Moderate majority on the London County Council announced a few weeks ago that "the trams were going to fight the 'buses." So far the only indication of fighting, which is more costly than working agreements, is a reduction of fares, accompanied by failure to make the reduced fares known. The only indication to the outside public so far is the appearance of a few notice boards on dash boards of some car platforms. Hidden as these are in the traffic, they might as well not be affixed. There is plenty of room for a bold announcement at the sides of the top decks. A good point about the advertisements of the London General Omnibus Company is that they are not confined to public traffic inducement, and promote hiring. Steps are also being taken to instruct passengers and non-passengers, adult and juvenile, in the prevention of traffic accidents.

NATIONAL STEAM CAR COMPANY.

In moving the adoption of the report and the payment of a dividend of 10 per cent., as against 8 per cent. for the previous year, Mr. W. S. Coles, chairman of the National Steam Car Company, said there was no suggestion that that company should be absorbed in the London traffic combine, and the board saw a bright future as an independent unit. If they eventually proved, as he believed they would, that their steam 'bus was superior to its petrol rival, it would seem that, being the only makers in the field, they would reap a great harvest through the ownership of these patents. Their engine, for instance, was particularly suited for light locomotives, and in the last few months they had been approached through the intermediary of one of the largest firms of locomotive manufacturers in the world and by three railway companies—one in England, one in South America, and one in South Africa. At the date of the balance sheet their 'buses had cost £55,838, or less than £700 each. That cost had a tendency to come down as more were produced, and in the past year they got it down to less than £600. They had 84 fully licensed 'buses all of the same type, and expected to have 150 during the present year, and 250 by the end of 1914. A test of a 'bus for military purposes resulted in 193 miles being traversed in one day with its allotted load under War Office supervision.

DAIMLER COMPANY TO SELL L.G.O. CHASSIS.

Now that the London General Omnibus Company are approaching the limit number of motor omnibuses which can be used, the Walthamstow works have been placed under the control of a company known as the Associated Equipments, Limited, with offices at Electric Railways House, Broadway, Westminster, and steps are being taken to place the company's productions upon the market. The Daimler Company, of Coventry, have been granted the sole selling rights throughout the world for the machines manufactured at Walthamstow, where Mr. W. J. Iden is the chief engineer. From these works 2,230 chassis had been turned out up to the middle of December, the manufacture of the improved B type dating back to October, 1910. It is not proposed at present to undertake the building of motor vehicles other than omnibuses.

INSTITUTION OF AUTOMOBILE ENGINEERS.

For the fourth meeting of the present session, at the Institution of Mechanical Engineers, Storey's Gate, Westminster, on January 8, the council had arranged for a paper to be read on "The Training of Automobile Engineers," by Messrs. B. W. Ainsworth, H. Burchall, C. E. G. House, and G. Campbell Taylor, members of the committee of the London branch of the graduates' section. A point of special interest in connection with this paper was that the authors having recently completed their course of education, were probably peculiarly well fitted to deal with the subject, and to point out the weaknesses in the courses of instruction which have hitherto been open. The subject is one of extreme importance at the present time to the industry generally, and although many schemes for prescribing a definite course of training for engineers generally have been discussed without result, it is hoped that by confining the discussion to a course designed for this particular branch alone, some tangible result may be arrived at.

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MOTOR TRAFFIC.

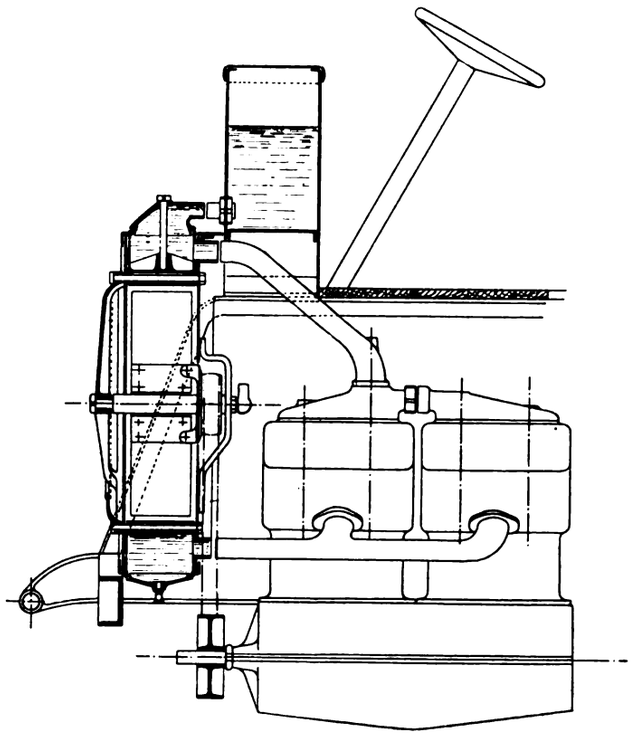
THE SOLEX RADIATOR.

An important improvement in the service of heavy motor vehicles has been made possible by the introduction of a new type of radiator which has been specially designed for this class of conveyance. With inefficient cooling arrangements the best designed engine will fail to give satisfaction, and the greater the horse-power the more difficult the problem becomes. The various types of radiators in use on industrial vehicles at the present time need constant attention in order that the losses of water due to evaporation may be made up, and quite apart from the fact that in the case of large fleets this becomes a charge of some importance, there is the result that as the water reaches a very high temperature it must necessarily reduce the efficiency of the cooling system.

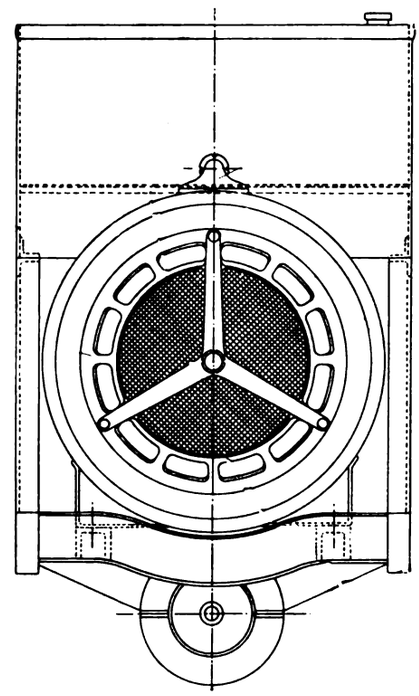
The Solex radiator has been devised for the cooling of heavy motors. It has an intense cooling action, and is constructed with due regard to the vibration to which the vehicles are subjected, also to withstand the hard wear inseparable from public service.

A good idea of the form of the Solex radiator will be gathered from the illustrations on this page, and the following is a brief description of its construction and working. The radiator consists of three main parts, the casing, the tube section, and the fan. The casing, of sheet steel, protects the tubes from damage due to vibration or wear. It is furnished with lugs, by which the radiator is fixed to the chassis. The tube section consists of a series of segmental copper tubes connected to two collectors, which are cast in bronze, thus ensuring ample seating for the tubes at the joint in holes of exact size and a perfect fit. The upper collector is provided with a reservoir if desired, otherwise, there is a metal cap, but either can easily be removed for the purpose of cleaning or repairs if necessary. The tube section is fixed to the casing by two bolts inserted through the collectors without passing through the water, thus insuring free play for the tubes.

The fan is mounted inside the tube section, and runs at a considerably lower speed than a propellor fan. It is mounted on a fixed spindle and runs on ball bearings. The spindle has its bearing in the casing at the back and in an aluminium spider frame at the front. An important feature in the design of this radiator is its simplicity and the ease with which the parts can be removed. By unfastening four bolts in the spider frame the fan can be taken out bodily, slots being formed in the casing for the passage of the blades, while the whole radiator can be removed from the chassis in a few minutes. Altogether this arrangement appears to form an extremely strong and efficient radiator. After lengthy trials, the Solex radiator has been exclusively adopted by the Compagnie Generale des Omnibus of Paris for its 800 new motor omnibuses, and Thomas Tilling, Limited, have also decided to have them fitted to their new petrol-electric omnibuses now under construction at the works of W. A. Stevens, Limited, at Maidstone.



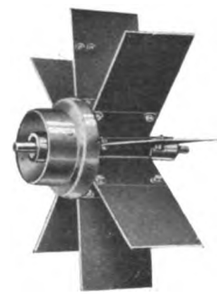
Sectional View.



Front View.

Solex Radiator.

Omnibus, with Solex Radiator.



Solex Radiator Fan.

Tube Section, in which Fan is Mounted.

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MOTOR TRAFFIC.

The reports from Paris are eminently satisfactory, the loss of water due to evaporation being practically nil. Amongst those on the Continent who are fitting the "Solex" radiator are Schneider and Cie, De Dion Bouton, Vinot and Dequingang, Mercedes, the Ministére de la Guerre, the Ministére de la Marine, Panhard and Levassor, Renault, Aster, Gnome, and the Italian Government.

THE LATEST LONDON AMALGAMATION.

A meeting of the shareholders of New Central Omnibus Company, held on December 16, Mr. J. O'Connor, M.P., presiding, passed the following resolution unanimously: "That the agreement of the 3rd day December, 1912, made between the New Central Omnibus Company, Limited, of the one part, and the London General Omnibus Company, Limited, of the other part, be and is hereby approved." The chairman mentioned that the company had operated a route between Chalk Farm (North London) and Waterloo station, and also to Kingston. They had a working agreement with the London General Omnibus Company, but lately the many services inaugurated by the latter in close proximity rendered the agreement of less value. As the result of representations to the company, the present excellent agreement had been made, providing for the letting of their fleet of 100 vehicles, accommodating 3,400 passengers, to the London General Omnibus Company for a term of 20 years. The rent would be a sum equal to that proportion of the net trading profits of the company which the seating of the vehicles taken over bore to the seating accommodation of the omnibuses owned and run continuously by the London General Omnibus Company; or a sum of £8,000 at the option of the company. The company could exercise this option once in every three years. The vehicles were to remain the property of the company, and were to be run and licensed in their name, and to be maintained in the best running order and in all respects up to date. He believed it had been stated that the profits of the London General Company for the year ended September 30, 1911, were approximately £349 per omnibus per annum. The average annual profits per omnibus in service of the New Central Company, computed on the returns for the nine months ended September 30, 1911, amounted to £240 per omnibus per annum. They were partners with the London General Company in their success without participating in any bad trade they might experience, in which latter case this company could and would exercise its option at the first opportuuity. In return for this agreement the London General Omnibus Company had undertaken not to be concerned in the running of omnibuses within a radius of 30 miles of London or 10 miles from Bedford, where the New Central had started a service; but these were the only restrictions, so that, if it is thought wise, this company could still continue its activities in the provinces and continue its policy of extension. This company could not make a trading loss. The paid-up capital was not quite £100,000, and an excellent return should be shown.—The report stated that for three years the London General Omnibus Company would pay a sum equal to the present remuneration of the board, and after that date remuneration at the rate of £100 per annum for each director during the term. The present managing director was to be taken over by the London General Omnibus Company, with a right to him to rejoin the board on special terms mentioned in the agreement. At a special meeting on January 2 the shareholders, by an overwhelming majority, empowered the present directors to continue to hold office during their lives as long as the agreement continued, and also authorised them to fill any vacancy.

PROPOSED OMNIBUS MUD-GUARD BY-LAW.

It was reported to the London County Council recently, by the Local Government Committee, that complaints have, from time to time, been made to the Council of nuisance caused by the splashing of mud by motor omnibuses and similar vehicles on to the person and clothing of pedestrians and on the windows of shops. As there appears to the committee to be ground for the complaints, it is proposed to consider the question of recommending the Council to make a by-law under Section 23 of the Municipal Corporations Act, 1882, and Section 16 of the Local Government Act, 1888, with a view to secure an abatement of the nuisance.

Splash Prevention Trials in France.

At the mud-guard competition for motor vehicles, recently held in Paris, the first prize, given by the municipality, was awarded to Messrs. Garcher for a straight rubber band which was fitted on each side of the wheel. The effect of this device was to throw the mud to the rear, the band being depressed by the revolution of the wheel. This was the only invention which provides a rubber band on both sides of the wheel, but there were a number with a band on the outside only. A representative of the traffic department of the Metropolitan Police attended the tests.

STOPPING PLACES OF TRAMCARS AND OMNIBUSES.

At the meeting of the London County Council on December 17, the Highways Committee recalled negotiations which had taken place with the Board of Trade regarding by-laws for the working of the tramways at Hammersmith Broadway. The Board of Trade by-laws proposed that all cars should come to a standstill opposite a new street refuge, but the Board subsequently, at the instance of Hammersmith Borough Council, altered the by-laws by the addition of the words "subject to any police regulations." The committee informed the Board that the Council objected very strongly to the insertion of the words. The Board had since replied to the effect that they were advised that having regard to the busy nature of the thoroughfare, the by-laws should be retained in their altered form.

The Hammersmith Borough Council had drawn attention to the danger and confusion created at Hammersmith Broadway and at the junction of Uxbridge Road and Goldhawk Road by the stopping of tramcars and motor omnibuses at the same places. The Borough Council stated that they had been in communication with the Commissioner of Metropolitan Police, the London General Omnibus Company, and the London United Tramways Company on the subject. The Borough Council also stated that pending the conclusion of the House of Commons Select Committee inquiry regarding motor omnibuses, it would be possible for the County Council and the Omnibus Company to arrange between them an immediate, although temporary, removal of the dangerous condition of things. The Omnibus Company and the London United Tramways Company had already agreed to discuss the matter with representatives of the Borough Council, and if thought desirable with County Council representatives. The Highways Committee recommended that arrangements be made for the County Council to be represented at any such conference. The General Purposes Committee proposed that the chairman of the Highways Committee and the chief officer of tramways should be the Council's representatives.

The report was adopted.

IMPORTANT PROSECUTION OF OMNIBUS DRIVERS.

At the instance of Mr. H. E. Blain, manager of the West Ham Corporation Tramways, two drivers of motor omnibuses were summoned at West Ham, on January 2, for driving to the danger of the public by "cutting in" in front of tramcars at stopping places. In the first case the evidence showed that in the narrow part of West Ham Lane, Stratford, the defendant, driving a motor 'bus, passed across the front of the car, within 18 in. of it, and pulled up on the near side. The car driver had no time to apply his brakes and only avoided a collision by reversing. About 20 passengers got off defendant's 'bus, and then he drove it leisurely in front of the car to another compulsory stopping place.

The defence was that the car was stationary, and that the 'bus was pulled up six or seven yards in front.

Mr. Blain said he had written repeatedly to the London General Omnibus Company as to the practice, which took place at nearly every stopping place, and was not only a nuisance but a positive danger to the public.

Mr. Gillespie said it was a serious case, and one which might have caused a serious accident; and it appeared to be a common practice. Defendant would be fined 40s.

In the second case it was said that a crowd of persons were getting on to a car when the defendant drove between the car and the kerb. The people had to scatter, and had not the tramcar conductor pulled a woman on to his car she must have been knocked down. In this case a fine of £2 was also imposed.

PRICE OF PETROL BY CONTRACT IN LONDON.

A year ago the motor cab companies of London made contracts at 6d. per gallon for petrol, to which had to be added 1½d. for half of the petrol duty. This year's supply is to be at 11d. per gallon, together with the half duty. Meetings of motor cab drivers have been held and resolutions passed refusing to pay the increased charge of 5d. to the men's employers and promising to support the executive in any action they deemed necessary. On January 1 some 5,000 of the drivers came out on strike. Two days later the strike extended to the provinces, although the provincial drivers are not members of the London men's union.

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MOTOR TRAFFIC.

LONDON STREET TRAFFIC ENQUIRY.

The Select Committee of the House of Commons appointed to enquire into accidents arising from motor traction in London, sat on December 17 and 19. Sir George Toulmin presided, and evidence was given by Sir William Byrne, assistant under-secretary in the Home Office; Mr. W. T. Jerred, an assistant secretary to the Local Government Board; and Colonel Yorke, chief inspecting officer of railways to the Board of Trade. Each of these witnesses defined in detail the powers of their departments as regards the traffic question generally under existing legislation, and expressed themselves satisfied that so far as their own department was concerned the law is sufficient and adequate for its purpose. At the same time, Sir William Byrne received the approval of the Committee when he remarked that speaking generally, the legislation on the subject of London traffic is redundant, defective, overlapping, and difficult to understand. None of the witnesses have been authorised by their departments to express officially any opinions as to what course should be taken in the future to mitigate accidents of the kind which the Committee have been appointed to enquire into, but they made certain suggestions which have come before the authorities, and which, in one or two instances, they expressed personal opinions upon. A proposal that imprisonment should be inflicted for a first offence against the Motor Car Acts did not meet with the approval of Mr. Jerred, nor did Sir William Byrne acquiesce in another suggestion that the onus of proof of negligence in the event of an accident between a motor vehicle and a pedestrian should be shifted from the pedestrian to a motor driver. At the same time, his view that juries are at present sufficiently disposed to find against motorists was disputed by several members of the Committee.

Present Powers of Control.

Members of both shades of political opinion upon the Committee have been very keen in their questions to bring out the multiplicity of control in London traffic matters, the authorities having a hand in these being as follow: Board of Trade, Home Office, Local Government Board, Police, Traffic Branch of the Board of Trade, London County Council as regards their parks, and Office of Woods and Forests as regards Royal parks. Owing to the restriction under which all the official witnesses suffer of not being allowed to express opinions on such a delicate matter, no definite information has been forthcoming to the Committee as to the possible advantages from concentration of the control under one authority. That the present condition of affairs leads to confusion is clear from the fact that during Colonel Yorke's evidence on December 19, certain figures which he put in, showing that the number of tramway accidents in London in proportion to the mileage run had considerably decreased of recent years, were found to be quite different from similar figures published officially by the Commissioner of Police. The nearest approach to a definite opinion upon the question of a traffic authority was made by Mr. Jerred, who stated that probably some advantage might be secured by an Advisory Committee consisting of representatives of the Home Office, Board of Trade, and Local Government Board. Such a body should evidently have some official powers, however, and another point brought out during the evidence was that although the Traffic Branch of the Board of Trade exists for the purpose of advising with regard to traffic matters, yet the Local Government Board have never yet consulted the Traffic Branch on any matter relating to London traffic.

Speed Limits and Stopping Places.

As to speed limits, both the Local Government Board and the Commissioner of Police are averse to fixing these unless the circumstances are quite exceptional. A great point was made by members on the Liberal side of the Committee that whereas the Board of Trade had complete control in respect to tramways, motor omnibuses were free from any control as to the routes, even from the police.

The Chairman, during Colonel Yorke's evidence, suggested that it might be in the interests of safety if tramways could be so constructed that at certain definite stopping places they were carried to the kerb, so that passengers could enter or alight from the cars in safety from the other traffic on the road. Colonel Yorke was against such a suggestion as impracticable. Incidentally, he rather took credit for the fewer number of people killed by tramways than by motor 'buses, on the ground that it was the function of his department to look after tramways from the point of view of safety both to the public and the passengers. In connection with accidents, he pointed out that in the case of the London County Council recently two instances where a tramcar passenger had been knocked down by a motor 'bus after having just stepped off a tramcar were reported to the Board of Trade as tramcar accidents, which, however, he thought was hardly the case. Dealing with narrow streets, Colonel Yorke also expressed the view that it was better in these to have the tram lines on the side of the road, and he had a preference for doing this in any street where there would be less than 9 ft. 6 in. between the rail and the kerb if the line were laid in the centre of the road. From Sir William Byrne's evidence, it would appear that the question of limiting the number of omnibuses in certain classes of streets has been under consideration, but under the existing law this could only be done where the conditions were held to be "especially dangerous," or where the road was less than 16 ft. in width. This, he explained, included the footpaths, so that the actual width of the roadway, assuming a 4 ft. pathway on either side, would only be 8 ft.

The Committee adjourned until after Christmas.

Life-Guards.

The Committee resumed their sittings on January 2, when further evidence was heard from Sir Horatio Yorke, chief inspector of railways and tramways. After pointing out that there are 72 miles of so-called tramways in the metropolitan area constructed under light railway orders, these being distributed in Barking, Dartford, Hertford, London United System, South Metropolitan Company, County of Middlesex, and Walthamstow, the question of accidents on the London County Council system was gone into. The following figures for the years 1908 to 1912 show that there has been a decrease in accidents, notwithstanding that there has been a considerable increase in the number of passengers. This is attributed to increased skill on the part of the drivers, improvement in brakes, and careful maintenance of life-guards. In 1908 the number of passengers was 597·14 millions; persons killed, 48; and injured, 731. In 1909 the figures were 637·36 millions, 39, and 1,874; in 1910, 705·97 millions, 45, and 1,313; in 1911, 780·97 millions, 36, and 918; in 1912, 809·37 millions, 38, and 1,062. These figures were again challenged by Mr. Kellaway, a member of the committee, as being quite different from those quoted by the police.

Sir Horatio Yorke's main evidence was devoted to tramway life-guards. The Tidswell type, he said, has been eminently successful, and the Board of Trade, although they have no power to prohibit the plough type of guard adopted in Liverpool, apparently do not regard it as so satisfactory. Figures for the County Council system were quoted, showing that from January 1 to December 31, 1912, 23 people were killed and 436 injured. In 43 cases the guard came into action, and in 41 the person was picked up. In five out of the 41 cases the person picked up was dead, and was found to be suffering from injuries which it was, said witness, fair to assume were sustained before the guard came into operation. In 32 cases the person picked up was injured, not seriously, and in four cases without any injury. In the two cases in which the guard failed to pick up a body, children were involved, and the possibility of a small child getting under the swinging gate some distance before it came into operation, thus bringing down the tray on the child instead of underneath it, was pointed out. The Glasgow returns for November show that in 10 cases a person or child was picked up by life-guards. The question of side guards between the wheels and the truck, and also between the front wheels and the swinging gate, was discussed, but the feeling of the Board of Trade is that no hard and fast rule can be laid down with regard to this.

Sir Horatio Yorke was questioned as to fitting guards to motor omnibuses, and he frankly said he would express no opinion, as he had not had an opportunity of studying an omnibus chassis from this point of view. Speaking without such knowledge, he anticipated that it would be impossible to fit a guard of the Tidswell type to a 'bus, and that in any case some considerable modification of the chassis would have to be made if a guard were to be fitted. A plough might be fitted to an omnibus, but, as already pointed out, the Board of Trade are not in favour of this, although, as a matter of fact, they have no jurisdiction over omnibuses. Sir Horatio Yorke confessed that he was not keen on omnibuses being placed in charge of his department. It may be pointed out that experiments are being carried on by the London General Omnibus Company with 'buses fitted with rear-wheel guards. The question of speedometers on tramcars was the subject of many questions, and the only extent to which Sir Horatio Yorke would commit himself was to say that if a reliable apparatus could be obtained the Board of Trade already had a regulation insisting upon its adoption.

Evidence from the City Corporation was commenced in the afternoon. This had, for the most part, reference to the powers of the Corporation as to control of traffic. Sir Homewood Crawford, the city solicitor, said the Corporation would strongly object to tramcars elsewhere than on the Embankment, and especially to a connection between Blackfriars Bridge and Farringdon Road, along New Bridge Street. They were quite willing, however, to allow tramways to be run under the surface, as was to be done in connection with the new St. Paul's Bridge.

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MOTOR TRAFFIC.

Motor omnibuses were discussed a good deal by Sir Homewood Crawford, and he differs from the City Commissioner of Police in that he would impose a speed limit in the City of eight miles per hour, instead of the 12, which now applies, whereas the Commissioner is satisfied that he can control the traffic without any speed limit. A question which, in his opinion, deserved very considerable consideration, is the consolidation of legislation as regards London traffic. The administration of any consolidated code should be in the hands of the police. The extension of the unique powers now held by the Corporation as to holding inquests upon fires, whether there have been fatal accidents or not, was suggested with regard to accidents in the streets due to traffic.

Finally, although the City Corporation have very extensive powers as to the control and diversion of traffic, yet even they cannot regulate the number of motor omnibuses on the streets, and Sir Homewood Crawford expressed the opinion that there should be power to regulate the routes which omnibuses should cover, although he did not actually suggest that the number of omnibuses on the roads should be limited.

EFFECT OF THE RIVALRY AT WALTHAMSTOW.

As a result of the keen competition between the motor omnibuses and their tramways, the Walthamstow Council have given the tramways manager instructions to prepare a report upon the effect of this competition, with a view to further reductions if found advisable. From the commencement of the Walthamstow tramway service in 1905, the most profitable section has always been the line from the Lea Bridge Road through Hoe Street on to Chingford Mount, a distance of some three miles, for which a charge of twopence was made for the full journey, with intermediate halfpenny and penny fares. Recently the London General Omnibus Company commenced a through service from the Elephant and Castle in South London, to Chingford Mount, *via* Lea Bridge Road and Hoe Street, with the result that the tramway receipts have steadily fallen. It is in order to recover some of the lost traffic that the Tramway Committee wish to issue full journey return tickets for threepence, and corresponding reductions on the intermediate fares. In connection with the fall in the tramway receipts a question was raised at the Council meeting as to the manner in which the members of the tramway staff performed their duties, the inference being that compared with the omnibus staff much remained in favour of the latter. It is understood that the tramways manager was given full power to deal with this matter forthwith.

"KYL-FYRE" DEMONSTRATION.

Some demonstrations which were recently given in Store Street, Tottenham Court Road, London, clearly showed the remarkable fire extinguishing powers of "Kyl-Fyre." Unlike all other chemical fire-extinguishers that have been placed upon the market, "Kyl-Fyre" is in the form of a powder. It is contained in a cylindrical tube 18 in. long by 3 in. diameter, and weighs 6 lb. The powder does not deteriorate, and therefore is always ready for use, no matter how long it has been in stock. Being a non-conductor and harmless to the most delicate machinery, it is claimed to be the most effective and suitable extinguisher for fires in connection with electrical machinery. "Kyl-Fyre" is instantaneous in its action, as immediately the powder comes into contact with heat a powerful gas is generated in which no fire can live.

The following demonstrations were given, and in each case the result of the application of the powder was most satisfactory: (1) Petrol was poured into a pail and ignited; the flames were extinguished instantly by a small quantity of "Kyl-Fyre" powder. (2) A quantity of petrol was poured on the ground, covering a considerable area. This was to represent a fire which frequently occurs in a garage. The petrol was ignited and "Kyl-Fyre" applied immediately. To show that the petrol had not burnt out or evaporated, it was relit and again extinguished. (3) A tar barrel, half full of tar, standing in a pool of tar, well saturated with petrol, was set on fire and allowed to burn till the tar boiled with the intense heat. The blazing furnace was then easily extinguished by "Kyl-Fyre." (4) A large pit of tar, ignited by petrol, and allowed to burn till it became a sheet of flame, was extinguished instantly. (5) A large wooden structure, containing 1,000 ft. of battens and other inflammable material thoroughly saturated with petrol and paraffin, was ignited and allowed to burn until the whole became a veritable inferno. This was reduced to a harmless mass in a few seconds by the application of "Kyl-Fyre."

Full particulars of "Kyl-Fyre" can be obtained from "Kyl-Fire," Limited, Eastbourne, or their London representatives at 7, Mark Lane, E.C.

LONDON OMNIBUS APPOINTMENTS.

In the House of Commons on December 19,

Mr. Kellaway (Bedford, L.) asked the President of the Board of Trade when the annual report of the London Traffic Branch of that department would be published; whether Mr. Fishbourne, now assistant manager of the General Omnibus Company, had had any part in the compilation of the report: if it was known while he was engaged upon this work that he had accepted an appointment under the motor omnibus trust; and whether he was in receipt of a pension.

Mr. Kellaway also asked at what date Sir Herbert Jekyll severed his connection with the Traffic Branch to become a director of the Company; if he was responsible for the last annual report of the Board of Trade on London traffic, and signed the same on November 30, 1911; if it was known, whilst he was engaged on this work, that he had accepted a position as a director of the trust; and whether he was now in receipt of a pension from public funds.

Mr. Buxton: Sir Herbert Jekyll retired on December 31, 1911, having reached the age at which civil servants are required to retire. I understand that some months afterwards he joined the board of the Omnibus Company. He was, of course, responsible for the reports issued by the branch of which he was chief, the last of which is dated October 31, 1911. He is in receipt of a pension from public funds. The latest annual report is now in the hands of the printers, and should shortly be issued. While Mr. Fishbourne was in the service of the Traffic Branch, he was employed in the ordinary work of the branch, including the preparation of the annual reports. He informed the Department of his intention on retirement to accept a post in the Omnibus Company. Mr. Fishbourne has no pension in respect of his service in the London Traffic Branch, but it is understood that he will receive temporary retired pay whilst serving as an officer of the Royal Engineers' Special Reserve. I think that, if my hon. friend wishes to make any charge against the Board of Trade or against either of the gentlemen he has named, he ought to state it directly, and not insinuate it through questions.

TODMORDEN MUNICIPAL OMNIBUSES.

A long discussion took place at a meeting of Todmorden Council on December 23 with reference to the recommendation of the Motor Omnibus Committee for the purchase of two engines and one engine and chassis from Leyland Motors, Limited, for the inclusive sum of £1,000. Councillor Wadsworth, chairman of the committee, stated that the omnibuses had now been running six years, and the committee had come to the conclusion that two or three of the engines were practically done, and with petrol at its present price it would be more economical to purchase new engines. He thought that the mileage they had got out of the new Leyland engine purchased six months ago warranted them in taking the step now proposed. Alderman J. Dawson protested against the proposal. The committee, he said, had overspent the capital cost of the 'buses by £3,000 in five and a half years. The cost of repairs in 1909, the second full year of running, was only £1,100; in 1910 it had been reduced to £1,074; but last year, with additional experience and the new engines, it went up to £1,807. Councillor R. Dawson, as a member of the committee, stated that owing to the cost of obtaining railless trolley car powers he had supported the continuance of the motor omnibus undertaking. When Todmorden started running 'buses, they, like Eastbourne, were pioneers, and had had to pay for their experience. Taking it all round the Leyland engines had done the best work, and were much stronger built. The committee had attempted as far as possible to standardise these engines. They had already three of this type, and if the recommendation of the committee was passed they would have six. The recommendation was adopted.

EXHIBITS AT THE PARIS SALON.

The heavy motor section formed a good display at the Motor Car Exhibition which was revived at Paris in December after having fallen through for two years. The British exhibitors were the F. I. A. T. and Foden Companies, and there were also several firms who have establishments in both countries, notably the Delahaye, De Dion Bouton, Panhard, and Renault. Several motor omnibuses were exhibited. Statistics taken at the Paris Salon proved very favourable to "Continental" tyres. Of a total of 3,486 pneumatic tyres, 789 bore the familiar "Horsebrand" trade mark, while as regards solid rubber tyres fitted to the heavy commercial vehicles "Continentals" were responsible for no less than one-third of the total—and this, when 19 different makes were represented

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MOTOR TRAFFIC.

MOTOR TRAFFIC NOTES.

SCOTTISH MOTOR TRACTION COMPANY.—A dividend at the rate of 7½ per cent. per annum has been declared for the year ended September 30 last.

CUSHIONS ON OMNIBUS TOP DECKS.—The London General Omnibus Company is providing top-deck passengers with cushioned seats. In view of the varying conditions of roads over which the vehicles travel, this attempt to give outside passengers the same comfort as those inside has been too long delayed.

TENDERS FOR MOTOR OMNIBUSES AND CHASSIS.—Warrington Tramways Committee on December 20 received tenders for the supply of three motor omnibuses, while Manchester Tramways Committee on December 24 received tenders for the supply of three motor omnibus chassis and one motor car.

MOTOR VEHICLES FOR STREET SCAVENGING.—It is announced that New York is about to utilise 35 motor vehicles for street scavenging purposes. Such conveyances have been in use for some years among municipal authorities in this country, notably by the City of London and Westminster Corporations.

DAIMLER OMNIBUSES AT HALIFAX.—The Corporation Tramways Committee have decided to provide a motor omnibus service for Siddal, a suburb of the borough, which is not reached by the tramways. The type of single-deck vehicle in use on the Mount Tabor route was illustrated in the issue of THE TRAMWAY AND RAILWAY WORLD dated December 12.

RECRUITS FOR LEEDS TERRITORIAL TRANSPORT.—At the prize distribution of the West Riding Divisional Transport and Supply Column held at Leeds on December 20, the commanding officer stated there were a few vacancies, which they wanted filled chiefly by mechanical transport men, for there was little doubt that the mechanical would soon largely supersede the horse-drawn vehicles.

"SHELL" TRANSPORT DIVIDEND.—The "Shell" Transport and Trading Company, one of the undertakings supplying petrol to this country, announce a second interim dividend at the rate of 10 per cent. Although the results of the year's trading have been exceedingly satisfactory, the directors have decided to reserve the increase of dividend until the final accounts have been received.

INCREASE OF CAPITAL OF THOMAS TILLING, LIMITED.—A prospectus was issued in December inviting subscriptions for an addition of £200,000 to the capital of Thomas Tilling, Limited, who run the Tilling-Stevens motor omnibuses in London. The company, who have a permanent agreement with the London General Omnibus Company, have 70 vehicles on the road, and with part of the new capital 80 more are to be built.

LONDON COUNTY COUNCIL "TO FIGHT THE MOTOR OMNIBUSES."—Lord Hill, addressing the members of the Greenwich Constitutional Club, contradicted a rumour that the London County Council contemplated scrapping tramways. Although it was not the Council's intention to bring forward at present any big extension, they proposed to link up the system so that there would be a complete circuit of cars. In addition, they were going to fight the motor omnibuses.

PRESSURE OF WORK IN THE MOTOR TRADE.—Replying to a local correspondent's request for larger motor 'buses in the hilly Ashley Down district of Bristol, Mr. C. Challenger, manager of the Bristol Tramways and Carriage Company, on December 17, wrote that the company were increasing the number of their chars-a-bancs as fast as they could get material from the makers of parts, but unfortunately they were as many months delivering as they promised in weeks.

MOTOR OMNIBUSES AND ABERDEEN TRAMWAYS DEPARTMENT.—Councillor Smith, chairman of the Tramways Committee, having informed the members that the department have no power to run omnibuses, except in the case of a tramway breakdown, or other emergency the committee have decided, on his motion to consider and report as to the propriety of including in the next Provisional Order power to provide, equip, and run within the city motor 'buses or motor cars.

MOTOR VEHICLES AT BATH.—The Sub-Sanitary Committee have recommended that the Bristol Tramways and Carriage Company be not granted licences for six motor cars enabling them to pick up passengers anywhere instead of as at present at the offices. Licences have been granted to the Bath Tramways Company for specially constructed motor cars for Lansdown and Bathwick Hill routes. Consideration of this company's application for licences for four touring cars has been adjourned in order to ascertain if they will restrict the use of the cars to week-days.

NIGHT CAB FARES AT LEEDS.—The City Council recently adopted a new by-law enabling a fare and a half to be charged by mechanically-driven hackney carriages when engaged between midnight and six a.m. Alderman Midgley explained that a representation had been made that there was a danger of taxi-cabs being withdrawn from the street, and that some of the companies could barely meet expenses. With the exception of London, where the conditions of night traffic were entirely different, nearly every town in the country granted the owners permission to charge the increased fare.

MOTOR LORRIES FOR SHEFFIELD HIGHWAYS DEPARTMENT.—The 5-ton lorry of 30 H.P., which was acquired by the Sheffield Corporation for the work of the highways department about a year ago, proved so satisfactory that a second vehicle of similar construction has since been obtained. The Surveyor of Highways, in a recent report, says that both are doing good service for the department, at a considerable saving in cost as compared with horse hire. Much of the work of the department has to be done under such circumstances that it is impracticable to use motor haulage entirely, but there are still other branches of the work for which motor haulage could be economically utilised.

THE AVON INDIA RUBBER COMPANY, LIMITED.—The greatly increased demand for Avon tyres which has occasioned the recent opening of several branches at convenient provincial centres for more rapid distribution has necessitated removal of the company's London depot, Long Acre, to larger showrooms and warehouses at 19, Newman Street, Oxford Street, W. A large stock of all their specialities, particularly of tyres for cars, motor cycles, and cycles, will be kept to give immediate delivery to their numerous trade friends, to whom an inspection of the new premises is cordially suggested. A staff of fitters is employed at the new premises, and customers' cars are fitted with Avon tyres free of charge.

OMNIBUSES FOR MILITARY WORK.—Motor omnibuses were used this year in the annual manœuvres of both the British and the German Army. Among the hired transport were six Milnes-Daimler omnibuses belonging to Bath Tramways Company, and these were suddenly utilised to convey a contingent of Liverpool Territorial Engineers a distance of 20 miles to place in a state of defence a 10 mile gap, 20 miles distant from their camp. In less than an hour several bridges had been placarded as destroyed and pickets posted. Concerning the Kaiser's manœuvres it is recorded that an innovation was the employment of motor omnibuses for troop transport. The surprise arrival of a heavy detachment of riflemen, who were rushed up in omnibuses, proved the decisive factor in a certain engagement. Motor cars, motor cycles, and motor trucks were used to an unprecedentedly large extent.

GENERAL MOTOR CAB COMPANY.—At the annual meeting on December 23, the chairman (Mr. M. Ritchie) stated the profit and loss account showed a debit balance of £148,922, but the debit balance on the year's working was only a small sum. The great bulk was due to a loss of £164,734 on the sale of cabs and cars. A large amount of the trading profit went to provide the £65,000 which had to be paid annually to the lenders of the £600,000. The company was reduced to the verge of bankruptcy before the reorganisation was carried out, and would have had to be sold up for the benefit of the debenture holders but for the faith shown by the French shareholders, who provided £600,000. A resolution was adopted in favour of cutting down the capital to £400,000. The Hon. Arthur Stanley, M.P., was one of the committee of management who, with the directors, took a hand in the reorganisation.

DEMAND FOR WORKMEN'S FARES ON MOTOR OMNIBUSES.—In the House of Lords on December 11 Lord Monk Bretton (L.U.) asked the Government if they could under existing legislation call upon omnibus companies in London to run workmen's 'buses at special fares, and if not, whether it was proposed to introduce legislation to deal with the matter. The County Council provided workmen's fares on their tramways at a cost of £130,000 to the ratepayers last year. In provincial towns the municipal authorities licensed motor 'buses, and were able thus to secure uniformity in traffic regulations. That illustrated the need for a Traffic Board for London. Earl Beauchamp (First Commissioner of Works) said the Government had no authority to interfere with the omnibus companies or to regulate them in any way, and he could hold out no hope that they would introduce legislation dealing with the subject in the present state of public business. Viscount Middleton (C.) expressed the opinion that something would have to be done sooner or latter in view of the enormous increase in motor 'bus traffic and the great expense entailed upon the road authorities. The immunity from rates which motor 'buses enjoyed, and the damage they did, in neither case applied to railways or tramways, and constituted a clear case for some interposition by the Government by the establishment of a Traffic Board.

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THE Tramway & Railway World
A REVIEW OF CURRENT PROGRESS IN ELECTRIC AND OTHER TRACTION

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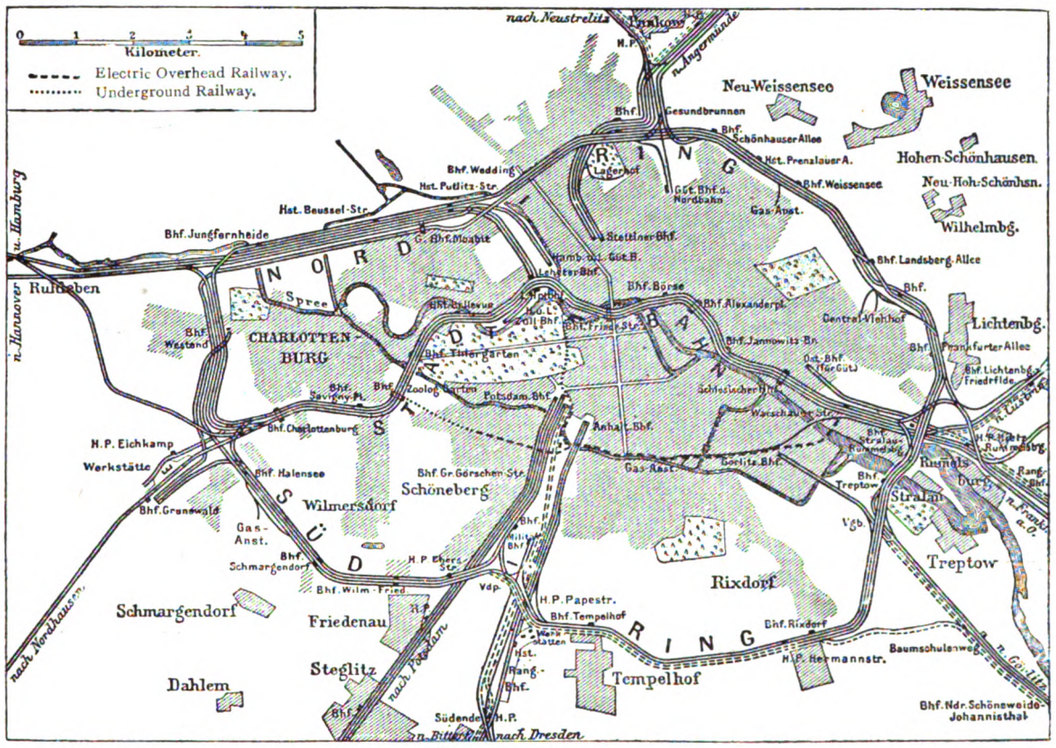
BERLIN MEANS OF COMMUNICATION.

Since the creation of the German Empire in 1871 the city of Berlin has by an uninterrupted development become one of the chief centres of the world's traffic. Year after year its traffic is assuming more gigantic proportions, and its means of communication have concurrently undergone a prodigious extension. Berlin has, in fact, come to be considered, as far as traffic facilities and regulation are concerned, as one of the best organised cities. Nevertheless, in Berlin, as in London, the traffic concerns are at present hardly able to satisfy all the demands of an ever-increasing population. The urban, circle, and suburban railways, electric street railways, elevated and underground railways, horse and motor omnibuses are constantly compelled to extend their services in order to keep pace with the city's development. Greater Berlin can now boast of an annual traffic of about 200,000,000 passengers (the nine urban railways of London convey annually about 370,000,000 passengers).

The rapid development of Berlin is chiefly due to the Urban Railway Administration. It has provided the city with a network of railways for local passenger traffic, of a kind that is unequalled anywhere else in the world. This railway system has enabled the inhabitants of the city to remove their residences into the suburbs, so that the inner parts of the city were transformed into commercial and industrial districts. As a glance at the accompanying map will show, the Urban Railway (Stadt Bahn), nearly 20 kilometres in length, from Stralau-Rummelsburg to Grunewald, forms the direct and shortest connecting link between the great International Railways reaching Berlin from the east and west. This railway forms, as it were, the diameter of the large circle represented by the Circle Railway, which, with its northern and southern circles, each being 21 kilometres long, surrounds the city. Both the Urban and Circle Railways are in direct communication with nearly all the long-distance trains arriving at Berlin, which pass over the Urban Railway. Berlin has long grown beyond its Urban Railway and even burst the fetters imposed upon it by the Circle Railway; and suburban trains now run, like the radii of a circle, in various directions.



Berlin City and Circle Railway, with Connections.

The Berlin Urban Railway is an elevated or overhead railway, passing above the streets and other means of communication. The masonry of its vaulted

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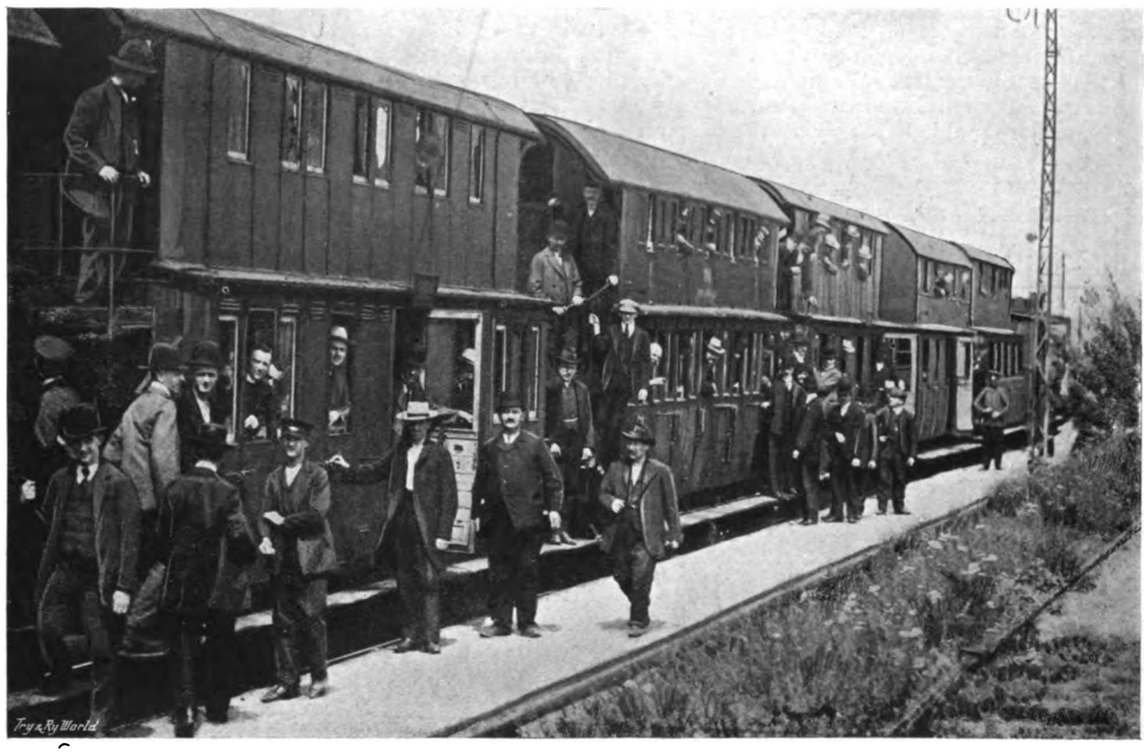
viaducts, with their high arches, extends right through the whole city and forms one of its characteristic features. There are practically everywhere four lines of rails. The trains are drawn by tank locomotives, having three axles, double coupled and external valve gear; the fuel used is coke, to avoid the smoke nuisance. Trains are, as a rule, composed of nine carriages (three being second class and six third class). The passenger cars are, like those of the German State Railways, divided into small compartments. The passengers themselves have to open and close the doors, and no names of stations are called out. Within the short time allowed for stopping, the passenger must, without asking questions or receiving information, unassisted find his place in the train and rapidly alight on arriving at the station of his destination. The Berlin public have been so well trained that traffic is carried on rapidly and smoothly. Traffic on the Urban and Circle Railways begins as early as four o'clock in the morning and lasts till one o'clock at night. Trains are run at intervals of two or three minutes. The fare from any station to the next fifth station (inclusive of it) is 10 pfennig (one and a fifth penny) third class and 15 pfennig second. For longer runs the fares are 20 and 30 pfennig respectively. Special reduced tickets are issued to workmen. No other large city in the world can boast of such cheap fares on its urban and suburban railways. The receipts (as in the case of the London Metropolitan District Railway) are far from sufficient to pay a fair rate of interest on the initial capital, after defraying working expenses, although approximately a million people are carried daily by the Urban and Circle Railways. What increasing traffic requirements have to be reckoned with in future is shown by the increase in the traffic experienced in the past. Traffic on the Urban and Circle Railways has increased from 75 million journeys in 1895 to 157 million in 1909. At present it is increasing at the rate of about seven millions every year. Suburban traffic has more than trebled within the last 14 years. With such increases in the traffic, the capacity of the railway is even now taxed beyond its limits. The trains, although they have been multiplied and lengthened as much as is possible, are at times unpleasantly overcrowded.



Double-Deck Railway Cars for Berlin Workmen.

ELECTRIC TRACTION.

For a long time the Railway Administration has been giving its earnest attention to the question how the carrying capacity could be enlarged, and it has now been decided to introduce electric trains in 1916. With the present steam trains the utmost that can be done is to run over the Urban Railway 24 trains per hour, each consisting of 488 seats, an aggregate of 11,712 seats. In order still to carry on the traffic under satisfactory conditions, in 1916 at least 30 trains will have to be run in each direction, each affording 610 seats, or in all 18,300 seats. By adopting electric trains it will, however, be possible to run about 40 trains per hour.

In the meantime, the other means of communication are also undergoing considerable extensions. Several new lines are being added to the underground railways in particular. It was at the Berlin Exhibition, as is well known, that Werner von Siemens demonstrated in 1879 the first experimental electric railway. Twenty-two years later the firm of Siemens and Halske, Berlin, was authorised to build an electric elevated and underground railway, 11 kilometres long, right across the capital from the Zoological Gardens to the Warsaw Bridge, with a branch to the Leipziger Platz. In the same year, the Elevated Railway Company was established under the guidance of the German Bank, its object being to build, in co-operation with the firm of Siemens and Halske, the main line and its future extensions. The concession does not expire until 1987.

THE ELECTRIC OVERHEAD RAILWAY.

The Elevated Railway Company now owns and works about 11·16 miles of high-speed railways, one-half being elevated and the other underground. The

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journey from the woodlands of the West End to the City (6·84 miles) is performed in 25 minutes, and to the east of the town (8·06 miles) in 30 minutes. To enlarge its present system the company intends to build five new connecting lines, of which two are to be opened for traffic in 1913. After the completion of all its sections, the network worked on a uniform system by the Elevated Railway Company will have a length of 27·28 miles, and consist of two large diagonal lines, having in common the central section (with Wittenbergplatz as joint station), and with several branches at their ends. The Elevated Railway is principally carried on iron viaducts, following the central line of of the streets. The architecture of its stations and viaducts is brought into line with the general character of the streets and squares. The platforms are about 21½ ft. above the ground. On account of the high underground water level the Underground Railway has been built at a small depth below the street pavement, and made proof against irruption of water. The platforms lie about 13 ft. below the street level. As a rule, straight and wide streets could be adapted as the route of this railway. In the city, however, certain sections had to be constructed under narrow streets and frequently under houses. An interesting transformation has only recently been completed at the reversing triangle of the junction station. The old reversing triangle, where three different traffic streams crossed one another, was a celebrated masterpiece of railway engineering. The frightful disaster, which took place at this spot four years ago—when one carriage fell into the street, and about 20 passengers were killed—gave rise to the reconstruction of this triangle. This has been carried out in such a way, that instead of three traffic directions, there are now only two, viz., the direction from the west to the City and the direction from the east to the reversing triangle and *vice versa*. For this purpose two stations have been built one above the other, intersecting at about a right angle. The two stations are connected with each other by a staircase giving means of communication for passengers changing from one line to the other.

The rolling stock of the Elevated Railway Company consists of 139 carriages and 112 trailers, in all 251 vehicles. Every carriage has four axles. They are wide and convenient and provided with sliding doors. Two different classes are run on the trains. Until a short time ago smoking carriages were provided, but these have now been discontinued for practical traffic reasons. Trains consist mostly of four to five carriages. The maximum speed is 31 miles per hour. The shortest interval between trains is at present two minutes. In 1911, 63·5 million passengers were carried by the Elevated Railway Company. In the inferior class the fare is 10 pfennig for five stations, and another 5 pfennig for every three additional stations. The extra charge for the superior class is 5 pfennig in the former and 10 pfennig in the latter case.

The system of the Elevated Railway Company communicates in the south-west with the Wilmersdorf and Schoeneberg Underground Railways. As the existing lines, the same as the Urban and Circle Railways, mainly extend in the west to east direction, the connecting links required to complete the system are, above all, north to south connections. A line is now under construction which, following the line of the Friedrichstrasse, is to run from the extreme north and, passing under the recently-built quarter in the Tempelhofer Feld, will extend as far as Tempelhof and Neucöln. It is the intention of the city of Berlin to build this line on its own account. But of perhaps even greater importance than this line would be, for the economic life of Greater Berlin, the creation of improved means of communication from Gesundbrunnen *via* Alexanderplatz to Neucöln. Approximately one million people, nearly one-third of the total population, reside at a distance of one kilometre from the stopping places of the High-speed Railway Line. A suspended railway scheme of the Continental Company for Electric Enterprises is

Station of Overhead Electric Railway at Nollendorf Platz.

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here competing, in order to secure the new line, against the elevated and underground railway scheme of the General Electrical Company.

TRAMWAYS AND MOTOR OMNIBUSES.

Owing to the creation of an extensive high-speed railway system the means of communication in the streets themselves had to be brought into line with this high-speed system. The Great Berlin Street Railway Company, by which nearly the whole of the Berlin street railway traffic is carried on, is ever anxious to extend the sphere of its operations. The total length of track worked by this company has been

Overhead Electric Railway Penetrating Building.

increased from 300 miles in 1902 to 330 miles in 1911. For many years there was war between the Great Berlin Street Railway Company and the city of Berlin, but the points in dispute were definitely settled in 1911. The city gave its consent to the company making use of the streets until December 31, 1939. On the other hand, the company is bound, at the city's option, either to surrender in favour of the city the concession obtained from the State, as from January 1, 1940, or to continue its exploitation. The city has, moreover, the right to acquire the concern as a whole on January 1, 1920, 1930, 1935, or 1940. The purchase price it would have to pay is the average dividend during the last seven years multiplied by 25. If the city should not make use of its right of acquisition, on the determination of the contract relations on December 31, 1939, the total permanent way, landed properties, means of exploitation and other movables used for the exploitation would vest in the city. The compensation paid, once for all, by the company to the city for all the rights secured to the company under its contract has been the sum of 23,000,000 marks. The company has obtained further protection against competitive lines by the grant of additional valuable concessions and rights of co-utilisation. The company's network comprises the whole of the city and nearly the whole suburbs. Service is given on 117 lines running in all directions from an early hour in the morning until late at night. Each car carries in front and at the rear a route sign in plainly legible figures or letters. The uniform fare for all sections, for the longest of which—the outer ring—the journey takes nearly two hours, is 10 pfennig. Only for suburban traffic are higher fares charged. No transfer tickets are issued. A few figures will give an idea of the magnitude of its traffic. The number of car journeys performed in 1911 was 8,505,574, and the number of kilometres run was 101,483,066. The number of passengers carried amounted, on an average, to 447,000,000, and 2,737 cars were in service. Working receipts amounted in 1911 to 43,484,055 marks, working expenses were 23,912,378 marks, giving a profit of 19,571,676 marks. In addition to the network of the Great Berlin Street Railway there are six lines worked by the Berlin Street Railway Joint Stock Company, which is a municipal concern, and several lines are worked by the suburban communities.

A very popular means of communication is the Berlin omnibus, which enjoys the patronage of the whole population. A considerable share in local communications of Greater Berlin is contributed, not only by the motor omnibus, but even by the old-fashioned horse omnibus. Its advantage over electric tramways is this, that whenever, owing to some current interruption or obstruction of traffic, an endless succession of electric cars is held up and unable to budge, the 'bus serenely proceeds on its journey. It has no fixed stopping places, but stops whenever a passenger wishes to get on or off. Besides, the horse 'bus is cheaper than the street railway. The fare for a divided section is only 5 Pf., for the whole section 10 Pf. The vehicles of the Berlin General Omnibus Joint Stock Company pass through the most frequented streets of the capital. At the end of 1911, 25 lines were worked by 470 horse omnibuses. The average number of horses was 4,865. By way of experiment a few mules have also been recently introduced, in order to ascertain whether better economic results can be obtained from them than from horses. These experiments have not yet been conclusive. Some horse omnibuses are drawn by one horse, others by two. In 1911 the number of passengers conveyed by horse omnibuses amounted to 111,241,651 persons.

The horse omnibus is gradually being supplanted by the motor omnibus. Motor omnibus traffic is carried on on eight lines, of which the most important line extends from the Hallesche Tor through the whole length of the Friedrichstrasse to the northern part of Wedding. The 96 motor vehicles of the omnibus company carried in 1911, 41,590,051 persons. The cars have outside seats. The company has its own workshops, where the

Berlin Single-Deck Motor Omnibus.

spare parts required for frequent repairs are made. The total number of passengers conveyed by omnibuses in 1911 was 152,832,602. The fares collected amounted to the sum of 11,184,335 marks. The last dividend the company has been able to distribute is 7 per cent. For excursions and tourists special motor cars "de luxe" are provided. On one of the western lines, traffic is kept up all through the night; otherwise, late night traffic is the province of the Berlin Omnibus Company, whose green cars are so familiar to the nightly frequenter of the Friedrichstadt.

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BERLIN'S TRAFFIC BOARD.

Within the last few years the capital of the German Government has become alive to the fact that certain measures will have to be taken to regulate in accordance with large, general, and uniform principles, further building operations of the gigantic city, and its sanitary, ornamental, and traffic requirements, so that an harmonious and convenient character may be bestowed on this rapidly increasing city. Much has already been achieved to realise this object. Suburban communities have been incorporated with Berlin itself into a Greater Berlin, and prizes were offered to obtain a suitable building scheme for Greater Berlin. Architects, engineers, and traffic experts have contributed their various shares towards the solution of this great problem. A number of schemes were awarded prizes and publicly exhibited three years ago at the Berlin Municipal Building Exhibition. This exhibition gave rise to the creation of an organisation by which the problems of town building and traffic are considered.

The Greater Berlin General Purposes Board (Zweckverband Gross-Berlin) was established by law in June, 1911. It has for its task to provide ample means of communication, to ensure the preservation of woods and open spaces, and to promote colonisation. It is designed to prevent the suburban communities from pursuing an interested policy of their own, without regard to the general community. The General Purposes Board is, therefore, to form a competent authority for town-planning and traffic questions, thus curtailing the power of individual communities.

Greater Berlin has grown up haphazard and without any uniform plan. The building plans of the individual quarters and suburbs were frequently drawn up without regard to their neighbours. The railways lie wedged in between masses of houses, incapable of any enlargement, and prove over long distances an obstacle to all cross traffic. At present there is a lack of large and straight street lines. No sufficient distinction is drawn between streets used for traffic and those used for residential purposes. All competent persons and bodies are agreed that the open country surrounding Berlin must be less compactly built on. In 1880, the population of Berlin was just over a million. Within 25 years, two millions have been added to it. The area occupied by them has been built over to a very large extent, and additional millions will find no accommodation within the areas hitherto built on. On the outskirts alone can they take up their residence. Of space there is plenty, but the distance of these future colonisation areas from the business quarters is even now so considerable that street connections and street railway connections are found insufficient. If these outer districts are, therefore, to be colonised, they must be opened up by high-speed railways, which will have to be built independently of roadway surfaces. In the various larger cities of the world it can be distinctly seen that their development takes place along the suburban railways. It is true that at Berlin the question of opening up the surrounding country areas has not yet become particularly urgent, because the nine million people who are to be settled there do not yet exist. What is far more keenly felt at present by the Berlin population is the lack of urban high-speed railways. Any reasonable further development of the town, any suitable settlement of future population, would be impossible without further developing in the right manner the inner and outer railway systems. To see to this is the first and foremost task of the Greater Berlin General Purposes Board.

In the Greater Berlin General Purposes Board the municipal community of Berlin, with its 15 suburban communities and two rural districts, is formed into one Communal Board of Supervision. The Board has the right within the district governed by it to acquire, build, and work railways and use the roads required for this purpose, paying compensation for them. The districts and communities within the area governed by the Board are bound to transfer to the Board on its demand the property in any railways belonging to them, together with all the rights and obligations connected therewith, against suitable compensation. Before building new railways, the districts and communities have to obtain the consent of the Board. The Board may, for parts of the area covered by it, fix general lines of direction for building purposes, as far as may be deemed necessary for the building and development of streets, construction of railways, or preservation of open spaces. It may also decide on the acquisition of considerable areas that are not to be built on, such as forests, parks, meadows, lakes, ornamental spaces, playgrounds, etc. It is authorised to collect dues and contributions from districts and communities. The organs of the Board are its Assembly, its Committee, and its Manager.

The Assembly of the Board is composed of the first mayor of the City of Berlin, Dr. Adolf Wermuth, as chairman, and 100 representatives elected by the communities according to the size of their population. The municipal community of Berlin itself is, in addition to its first mayor, represented by 40 members. Representatives are elected for six years by the Representations of Communities, in towns, with the co-operation of the Municipal Council. For each member a deputy is elected, who is competent to act for the member in cases where the member is unable to be present. The Committee of the Board is composed of the first mayor of the city of Berlin, as chairman, one member of the Berlin Municipal Council, and six mayors of the communities next in order of population, the chairman of the District Committee, and eight other members. The Board Committee passes resolutions on all matters of the Board which have been prepared by the Board Assembly. It is, therefore, strictly speaking, the executive organ of the Board. The manager of the Board conducts the current business of the Board Committee. The manager is the superior of all the officials of the Board, and represents the Board externally in all matters. The present manager of the Board is Dr. Steiniger, an official who has had great experience in communal matters. An expert adviser on traffic questions, Professor Erich Giese, who is regarded as the leading authority on Berlin traffic matters and a traffic expert of tested ability, is attached to his staff. In his former capacity of chief constructional engineer of the Berlin Railway Administration Dr. Steiniger was in charge of the construction of the first Berlin underground railway. On building questions the manager of the Board is advised by Mr. Kiehl, municipal counsellor of building and architect of the General Purposes Board. The General Purposes Board entered upon its functions on April 1, 1912, and has already given proof of being a body well fitted for its purpose.

Bradford Early Morning Halfpenny Fares.—The report published in our issue of January 9 of the meeting at which the Tramways Committee received the half-yearly financial statement, mentioned that the decrease in revenue on account of the introduction of halfpenny fares up to 9 a.m. had not proved so large as the general manager, Mr. C. J. Spencer, originally estimated it would be. Later information shows, however, that Mr. Spencer's estimate was singularly accurate. In fact the loss was, actually, a little more than the estimate. That the general manager's forecast of the result was so exact incidentally affords proof of the thorough grasp which the tramway department has of the conditions of the traffic and the requirements of the public

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MANDALAY ELECTRIC TRAMWAYS.

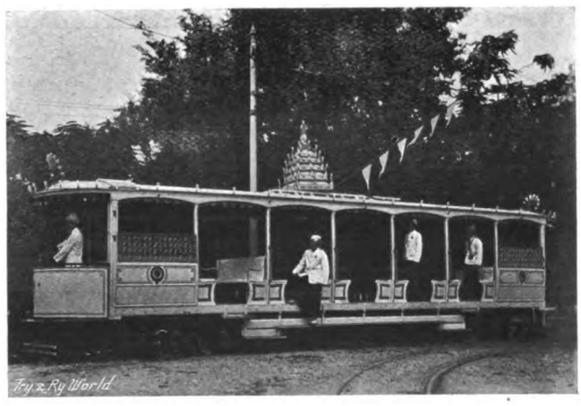
This system of tramways, which bears the description of the Burma Electric Tramways and Lighting Company, Limited, was officially opened by Sir Hugh Barnes, K.C.S.I., then Lieutenant-Governor of Burma, in July, 1904, and was opened for public traffic from August 1 of that year. The vicissitudes of fortune have hit this enterprising venture hard from its very inception, as between the time of its promotion, in October, 1902, and of its completion, in June, 1904, the aspect of the proposition was already rendered less promising by the removal of almost all British troops from Mandalay, and by the transfer of a number of important Government offices to the hill station of Maymyo, the summer headquarters of the local Government. This was, however, only the beginning of adversity, for in January, 1906, when the company's system had been barely 18 months in operation, Mandalay was afflicted with a severe visitation of plague, causing fearful mortality, disappearance of inhabitants, and temporary paralysis of trade. Another severe epidemic of the same fell disease followed in the cold season of 1906-7, a third and fourth in 1908-9 and 1910-11, with lesser epidemics in the intervening seasons. In fact, for five years Mandalay was under the baneful influence of plague, whilst in the summer season of 1909 the town experienced an unusually acute epidemic of cholera. In April, 1910, a large portion of the town, abutting on to the shore section of the tramway system, was devastated and destroyed by a tremendous fire, causing widespread distress and loss of property. From the foregoing, it will be seen that Mandalay's cup of bitterness has been full, and probably no other commercial venture of its kind has had such a multiplicity of setbacks to contend with in its first few years of working as the Mandalay tramways.

Clock Tower Junction at Mandalay.

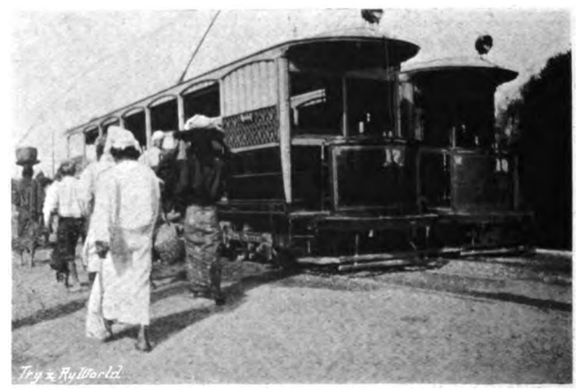
The plague epidemic of 1911 and 1912 was fortunately extremely light, and it may be hoped that plague in Mandalay may at last be reckoned as a spent force. Meantime, however, it may be noted that the concomitant expense of the maintenance of a large and costly plague staff for five years so strained the financial resources of the local municipality, that no important public works of development could be entertained. For this reason the lighting side of the Mandalay company's venture has not had the scope and encouragement it might have looked for in any scheme of town lighting. The plague staff having been abolished, however, some months ago, it is reasonable to suppose that municipal funds will, at no distant date, be forthcoming for modern improvements.

In our issue of October 13, 1904, the lay-out of the tramways was described. A small extension of considerable importance was made in January, 1907, to Shanzu, from the line running to the Arakan Pagoda; Shanzu being the railway station next south of Mandalay and three miles distant from Mandalay railway station. The linking up of bazaars with this favourite Burmese debarking station was a wise move, which has fully justified expectations.

Mandalay was the gainer in April, 1910, of the highly prized relics of Gautama Buddha which were discovered in 1909 near Peshawar and now find a temporary resting place at the Arakan Pagoda, but are in due course to be transferred to a shrine specially constructed to receive them on a spur of Mandalay Hill. In respect of this conspicuous prominence, about 1,000 feet high, situate three miles north of the centre of Mandalay, enormous improvements have been made in the past three years, replicas of two famous images which were destroyed in 1892 having been set up on the Hill and the Kyauktawgyi Pagoda at the foot having been recrowned by a Southern Shan State Prince, apart from the addition of ornamental covered stairway



Special "White Car"—Mandalay Tramways.



Passengers Entering Cars.

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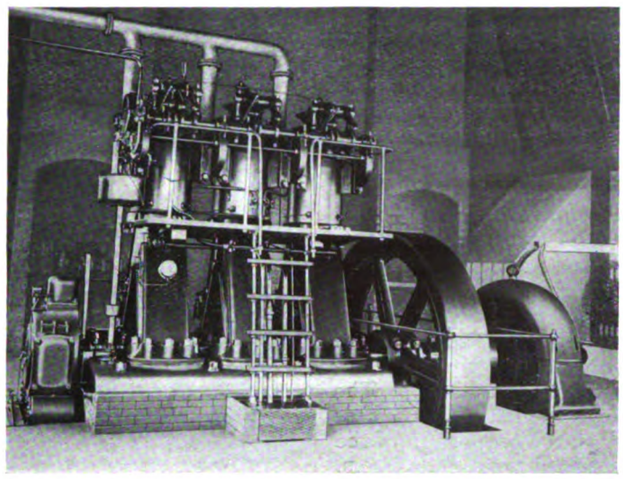
approaches to the hill top. These additions, enhanced lately by the recrowning of the Kuthodaw Pagoda, on which large sums of money have been expended, have rendered Mandalay Hill a very attractive object of pilgrimage.

The population of Mandalay, which was 183,816 in 1901, was returned as 138,456 in the census of 1911, a decrease of 45,000 inhabitants, or 25 per cent. less. As, however, the census of 1911 was taken towards the close of a severe epidemic of plague, causing an exodus of people from the town, it was recognised that the census figures were misleading, and that had the census been taken a few months later, when the population was back to normal, the returns would have been 150,000, being 33,000 down, or an 18 per cent. decrease. In any case it would seem that Mandalay has now weathered its troubles and has seen the worst, so that a further decline is improbable. This anticipation has been borne out in the course of the past 18 months by municipal sales of bazaar leases at advanced prices which, moreover, by increased trade activity during the past few months, appear to be justified.

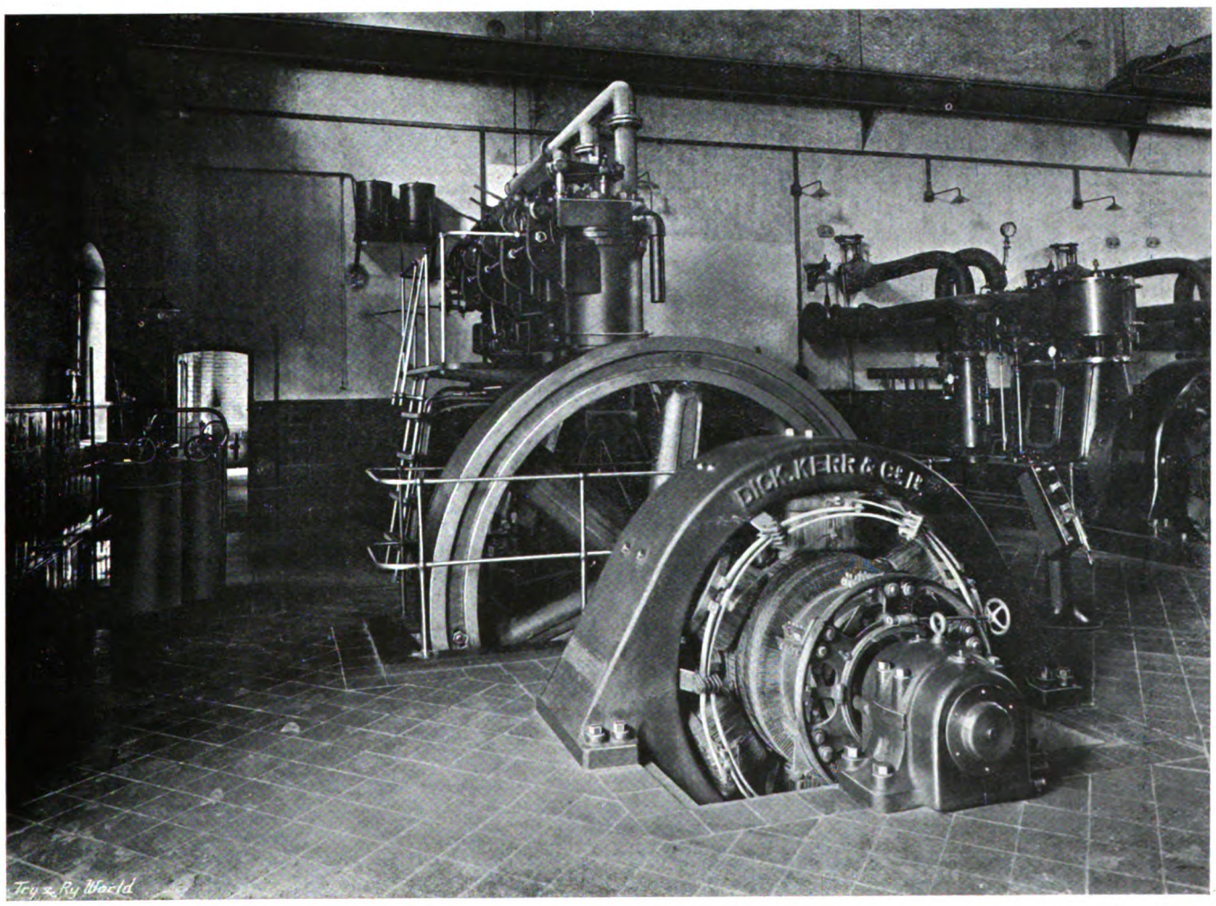


Side View of Diesel Engine—Mandalay Tramways.

The tramways have a route length of nearly seven miles, double track throughout. The rails are 6 in. deep with 1¼ in. grooves, laid to a gauge of 3 ft. 6 in., and are double spiked to hard wood sleepers which are laid at 2 ft. 9 in. centres on a ballasted bed, the road surface being made up with macadam. This method of rail laying gives a very flexible bed, and no trouble has been experienced with loose or hammered rail joints, nor has any sign of corrugation appeared after eight years' working. The joints are of the plain type, and are secured with six-holed fish plates. Two 4/0 B and S Neptune bonds are used at each joint and the usual cross bonds.

The overhead equipment is on the span wire system. The standards are of solid drawn weldless steel tubes, with an overall length of 28 ft., set 6 ft. into the ground. The trolley wires are of hard-drawn copper 0·364 in. diameter. The usual section insulators and lightning arresters are provided. A very complete feeder system is installed, consisting of soft-drawn copper wires mounted on toggle insulators fixed on malleable iron brackets attached to the trolley wire standards.

The rolling stock consists of 24 electric cars and one



Dick-Kerr Generator and Diesel Engine—Mandalay Electric Tramways.

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water car, constructed by the United Electric Car Company, Limited, Preston. The passenger cars are designed to seat 48 passengers, and are built of teak. Sun blinds are provided for each side entrance, sliding in grooves between the posts. The trucks upon which the cars are mounted are of the Brush Company's four-wheel type. The cars are fitted throughout with Dick-Kerr equipment, consisting of two Dick-Kerr standard 25 B traction motors, capable of delivering approximately 28 H.P., the temperature of the various parts not exceeding 75 deg. C. after running at full load for one hour. The controllers are of the same firm's standard D.B.I. form, C type.

The water car has a tank capacity of 2,500 gallons, and is capable of watering the full width of the road when required. It is mounted on standard Brill four-wheel trucks, and has proved a great boon to the town.

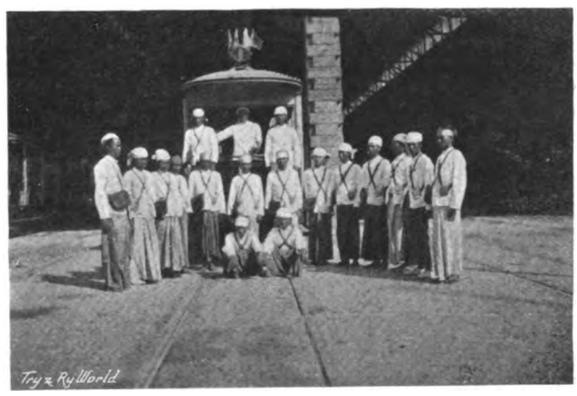
The power-station is situated on the company's site in 78th Street, together with car shed, repair shops, and offices. The original steam plant consisted of three Babcock and Wilcox boilers and three steam-driven Belliss, Dick-Kerr 300-B.H.P. machines. The boilers are designed for burning wood fuel. The cost of fuel has always been a very large proportion of the total cost of supply, and in November, 1911, a 225-B.H.P. Diesel engine was put into commission. The engine was built by Messrs. Willans and Robinson, under patents held by the Diesel Engine Company. It is of the three-crank type, single acting, with water-cooled cylinders, runs at 195 revolutions per minute, and has an overload capacity of 20 per cent. for one hour. The engine drives a 150-KW. dynamo, constructed by Messrs. Dick, Kerr and Company. In addition to the Diesel engine, the company have installed a Tudor traction battery of 415 ampere-hours' capacity, and a Lancashire Dynamo Company's automatic booster.

The Diesel set uses crude oil, obtained in Burma, which comes to Mandalay by river, and is hauled from Mandalay shore to the company's compound by electric car and stored in two underground tanks constructed of brick-work and concrete, each capable of holding about 6,000 gallons. To make room for the Diesel engine one of the steam sets has been removed, and steam is now only used as a stand-by. The saving in working expenses has been fully up to the company's expectations. The switchboard, constructed by Messrs. Dick, Kerr and Company, is situated on a slightly raised platform running down one side of the engine room, and the battery is placed in a room immediately adjoining.

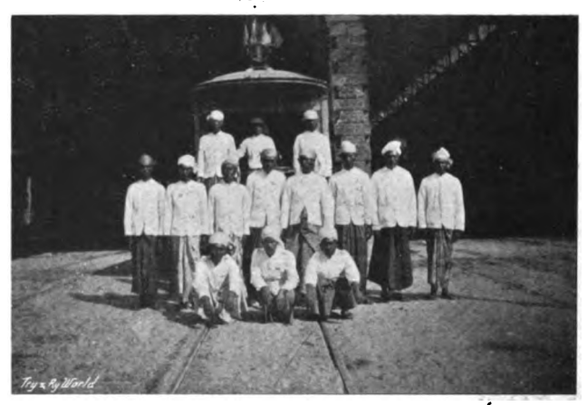
The repair shops are situated alongside the car sheds and contain the necessary lathes, drilling machines, &c., all driven by electric motor. Here, all the company's repairs are done, and, in addition, a good deal of work for outside firms and individuals. The company's contractors for the whole of the installation were Messrs. Dick, Kerr and Company, of London.

In 1909, a licence was granted to the company to sell electricity for lighting purposes at the somewhat unusual voltage of 500. By adopting this pressure, the company have been able to supply direct from the trolley wires or tramway feeders in many instances, and are also able to dispense with any special lighting plant in the power-house. At first sight, 500 volts seems a very high voltage to introduce into houses and shops, but it must be remembered that Mandalay is in what is known as the "dry zone," and there is little risk of leakage due to damp. In actual practice there has been no difficulty whatever, and, if anything, less trouble with faults than would be expected with a 250-volt supply. The only disadvantage is that two lamps must always be burning together and two fans running together.

Arakan Pagoda.



Group of Burmese Conductors.



Burmese Motormen.

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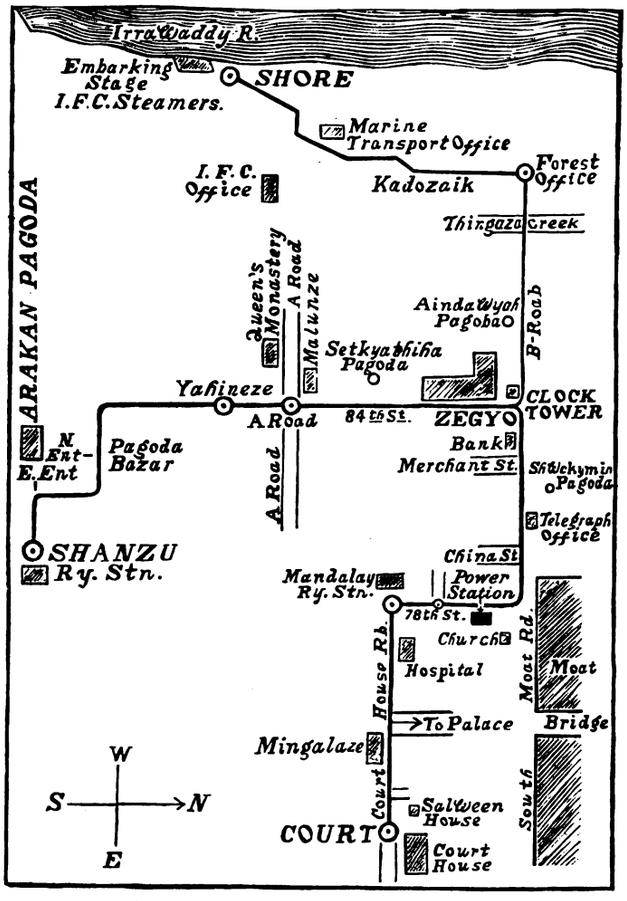
The company have on their books as consumers Europeans, Burmans, Chinamen, and natives of India, so that the difficulties of canvassing for new consumers will be realised.

Several pagodas are electrically lit by the company, the first installed having been the world-renowned Arakan Pagoda in January, 1906, immediately prior to the visit of T.R.H. the Prince and Princess of Wales, now the King and Queen. The shrine of the Arakan Pagoda was then installed with 40 lights, and it is believed that its Buddha was the first ever electrically illumined.

In March, 1910, the bell-shaped Aindawyah Pagoda was installed with 10 lights beneath its Hti or umbrella, the universal crown of all pagodas, at 100 ft. from the ground. This very effective form of lighting appeals strongly to Burmese sentiment, and was followed in



Outline Map of Mandalay Tramways.

September, 1912, by the lighting of the Hti of the Arakan Pagoda at a height of 160 ft. from the ground. Another pagoda has the whole of its platform or base extensively electrically illumined, and trustees of other pagodas are now in treaty with the company for lighting their shrines or Htis.

The company have been staunch and generous supporters of Burmese labour from the commencement, out of their total staff of 293 in Mandalay 222 being Burmans. The traffic staff is almost wholly composed of Burmans, and of the remainder the only important exceptions are the permanent way and O.H.L. staffs, for which Burmans are unsuitable. In this connection it is interesting now to note that in 1904, when the Mandalay Tramways staff was being collected, the company's representatives came in for considerable criticism for their preference for Burmans, whom querulous critics thought would prove careless, slothful, and irregular workers. The company's whole-souled enthusiasm for the people of the country, has, however, been splendidly vindicated by results, for the misgivings have been routed, the Burmans proving on the whole careful, industrious, and attentive to their duties, whilst as skilled artisans it is probable that they can hold their own anywhere east of Suez.

The manager of the Burma Electric Tramways and Lighting Company, Limited, in Mandalay, is Mr. A. C. Morgan, to whom we are indebted for this account of the undertaking and the accompanying illustrations.

RAILWAY ELECTRIFICATION IN PRACTICE.

Mr. Dawson at the Permanent Way Institution.

The announcement contained in an article on another page of our present issue as to the sections of the London and Brighton railway system which are next to be converted to electric traction, gives added interest to the paper read by Mr. Philip Dawson before the London section of the Permanent Way Institution an January 14 last. In this paper Mr. Dawson dealt with the work of electrification which, under his auspices, has already been carried out on some of the suburban lines of the London, Brighton, and South Coast Railway, and he paid special attention to the features likely to be most interesting to members of the Permanent Way Institution. Mr. Dawson made a comparison of the third and fourth conductor rail system of electric traction with which direct current at 600 volts pressure is used, with the single-phase alternating-current system with overhead wire conductors, and a pressure of several thousand volts. Mr. Dawson naturally favoured the single-phase system, and advanced many reasons for his belief, including the favourable experience of the economy of the method in foreign countries. Apart from any other consideration, the choice between the two systems is of great interest to permanent way men in view of the profound differences of track arrangements which they involve. The lecturer gave special attention to the subject of the extra wear of rails under electric traction where motor coaches are used. The causes of the extra wear were enumerated as the method of propulsion, the large increase in mileage, small wheels, short wheel base, low centre of gravity, high rate of acceleration and deceleration, and weights not spring-borne. Many of these drawbacks do not exist if separate electric locomotives are used; indeed they punish the track less than steam locomotives, and they will have to be used for long-distance and high-speed services. The two cardinal reasons which decided the choice of system for the Brighton Railway were given by Mr. Dawson as, first, the undesirability of using a third or fourth rail conductor, with its disadvantages as regards maintenance of permanent way and additional danger to the staff; second, the necessity of adopting a system which could easily and economically be extended to Brighton and Eastbourne. The lecturer subsequently spoke of the difficulties in designing and erecting the complicated overhead work on the Brighton line. The sound mechanical construction aimed at has been fully achieved, the energy consumption per ton-mile, notwithstanding the many adverse gradients out of stations and the numerous curves, has been remarkably low, and the cost of maintenance has been entirely satisfactory. The way in which the service is working may be gathered from the fact that the average mileage run by every coach owned, including spares, is from 50,000 to 65,000 miles per annum. Some of the motor coaches run over 300 miles a day.

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THE

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LONDON, FEBRUARY 6, 1913.

London Traffic Inquiry.

If anything could move the Government to give the metropolis the independent London Traffic Board recommended by the Royal Commission which inquired into the needs of the capital, it should be the evidence which Sir Edward Henry recently gave before the House of Commons Committee now engaged in inquiring into traffic accidents. Under the ægis of the Home Office the Metropolitan Police have pursued a policy of resisting many tramway proposals brought forward by the County Council, a state of affairs which provincial authorities have not to meet when their bills are considered in Parliament. No surprise will be occasioned by the Commissioner having been asked by a member of the Committee whether he was not prejudiced against tramways. A disclaimer was indignantly given, but, as Sir George Toulmin remarked, Parliament has sanctioned the construction of tramways, and passengers are entitled to protection. In a two-fold manner protection is denied them. Although the police are hourly witnesses of the danger to which passengers are subjected by motor omnibuses being driven through them in order to pull up level with the cars, we have not yet observed a prosecution by the police themselves. Such driving is an offence under section 1 of the Motor Car Act, as well as under the ordinary law. So far the prosecutions have been instituted by the West Ham, East Ham, and Croydon Corporations, and by the County Council. All over London the police may be seen at stationary points, a few yards away from stopping places, giving attention to everything except the safety of tramcar passengers. In opposing applications made to the Local Government Board for reduced speed limits for motor vehicles, the Commissioner has professed to be able to deal with offenders under section 1, which is so apposite to the harrying of tramway passengers that it will bear quoting in full:

> If any person drives a motor car on a public highway recklessly or negligently, or at a speed, or in a manner which is dangerous to the public, having regard to all the circumstances of the case, including the nature, condition, and use of the highway, and to the amount of traffic which actually is at the time, or which might reasonably be expected to be, on the highway, that person shall be guilty of an offence under this Act.

This clause is so well understood by drivers of private cars and cabs that they invariably come to a standstill if there is not room for them to pass without scattering persons entering or leaving tramcars. The second method of protection which it is open to the police to insist upon is to be found in the fixing of stopping places for motor omnibuses. This course is taken in streets where there are no tramways, and if it is possible there, the same procedure should be insisted upon elsewhere. Yet Sir E. Henry considers that the safest arrangement is for the two vehicles to stop at the same places, but with the nose of the omnibus at such a distance from the tail of the car as to leave sufficient clearance for passengers to get on and off the car without any risk of being run down. This proposal does not square with the threat of legal proceedings by the police against the County Council for refusing to comply with their request to cease using an old-established stopping place in Kingsland Road which is now used by motor omnibuses. It is also in opposition to the evidence given by Sir E. Henry before the House of Commons Committee in his endeavour to show that tramcars are an obstruction to following traffic because their length renders it difficult for other drivers to see vehicles coming from the direction of the head of the car. With the line of a tramcar

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prolonged by a motor omnibus behind it or on its near side the difficulty of other drivers is doubled, and, moreover, they must either continue the line of obstruction or take the risk of meeting traffic on the other side. Yet Sir E. Henry gave this as his reason for objecting to trailers being attached to tramcars, in advancing which objection he ignores the testimony given in many other countries that a train of cars reduces congestion. A few of the motor omnibus drivers make their stopping places a reasonable distance from the cars, and there is no reason why others should not follow the same plan. Even the *Pall Mall Gazette*, which has frequently opposed tramway extensions, has been moved by the Commissioner's evidence to declare that "if he desired to drive tramcars off the streets altogether he could not have hit upon a more fiendishly ingenious manner of doing so; and, indeed, in reply to a question of one of the members of the Committee, he admits that he is no friend of the tramway. How does he, then, propose to supply its place in conveying the 500,000,000 passengers who now use the tramcars to and from their daily toil? By trebling the number of motor omnibuses? If this is his solution, it is as impracticable as his other suggestion of a uniform speed for all vehicles." The *Pall Mall Gazette* maintains with truth that compulsory stopping places for omnibuses are urgently needed, but asks, if this matter is left to the police, will they make any better use of such limited powers than they have done in the past? Our contemporary cites instances of muddled management of traffic between Piccadilly and the east end of the Strand. Returning to the question of protection for the public on routes used by both omnibuses and tramcars, we may point out that if the police continue their policy of inaction it is not unlikely that private individuals will combine. One outcome of that course might be seen in a demand for a change in the Chief Commissionership, and the bestowal of powers on the County Council similar to those possessed by the City Corporation, at whose request the Lord Mayor has asked the Court of Aldermen to arrange with the Commissioner of the City Police that his powers should be put into force at once for the protection of the public by reducing speed to whatever limit he considers to be safe. If the police are not prejudiced, why, may we ask, did they present a misleading return? Their figures show 292 deaths due to motor traffic on 149 miles of tramway streets in the two years and nine months ended September last, as against 199 fatalities in the "more busy non-tramway streets," with a mileage of 215. Sir E. Henry's use of the phrase, "more busy non-tramway streets," implies that those thoroughfares were motor omnibus routes, but an analysis since made reveals the fact that in 30 miles of such streets there were no omnibus routes.

Prime Movers of the Future.

Greenock never ceases to be proud of the fact that James Watt was born within her territory. The rest of the world is not allowed to forget the place of nativity of the famous pioneer in the world of steam engineering, because year after year a Watt anniversary lecture is delivered under the auspices of the Greenock Philosophical Society by some man eminent in physical science or engineering. This truly admirable arrangement was perhaps never more justified than it has been this year, when on January 16 Mr. S. Z. de Ferranti delivered the lecture. No name is better known in connection with the practical application of steam power and the generation and distribution on a large scale of electrical energy. Electric traction and electric lighting, as well as the application of electric motive power in various industries, owe a great deal to Mr. Ferranti, but beyond and behind that he has studied the problem of reducing the cost of fuel by means of improved engines, and of methods as yet undiscovered of directly converting the energy in coal into rotary motion. Hence he was highly welcome as the Watt lecturer when he discoursed on prime movers. His historical sketch was interesting, but greater importance is to be attached to his opinions in regard to the future of the steam turbine and the internal combustion engine. These two prime movers are now competing for first place in furnishing the world's power. The lecturer's assertion that for large powers the turbine is practically unassailable, and that for small powers the internal combustion reciprocating engine is the best, will command very general assent. Mr. Ferranti showed that as the turbine becomes larger, so it is easier to

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construct, and it also becomes more economical. On the other hand, as the gas or oil engine becomes larger, so the natural difficulties increase. He thinks that the division of the means of power production by large and small units between the rotary and reciprocating machines is almost a natural law, and that those who seek to evade it must either invent some new principle or incur endless trouble, expense, and failure. He, therefore, considers that the advocates of the Diesel engine for marine purposes who are spending vast sums of money are on the wrong track. Here it is, of course, that the believers in the Diesel engine will join issue, but it is undoubted that great expense and many failures have marked experimental work in this direction. Still, as Mr. Ferranti himself points out, the steam turbine was only developed to its present excellence through a long course of trials, and for years it could not hold its own in economy with a reciprocating engine. Many troubles and not much tangible success have attended the attemps to produce satisfactory gas engines of large power, but the Diesel is not the same thing as a gas engine, although internal combustion is common to both. If it does prove a success for large powers it has still a long way to travel, but it would be rash to affirm a limit for it at present. At the same time, it has to be remembered that the turbine shows no sign of having reached the highest perfection to which it can attain. Mr. Ferranti quoted figures of steam consumption by his own make of turbine which are extraordinarily low. With a 5,000-H.P. machine the consumption is given as 6 lb. of steam per shaft horse-power—presumably per shaft horse-power-hour. The steam is not only highly superheated before entering the turbine, but is re-superheated before passing into the second stage of the turbine, and it is exhausted still in a superheated state through a regenerator. All these matters are of as much interest to those concerned in electric power-stations as they are to marine engineers and shipowners. We are not yet by any means at the end of development of prime movers, but whatever the future may bring forth it is at least certain, as has been on previous occasions pointed out in these pages, that the day of the large-power reciprocating engine in electric generating stations is nearly over.

London Railway Electrification.

We have recently published particulars of the large electrification schemes about to be carried out in the London district by various leading railway companies, but probably few people have an idea how great a mileage is involved when the schemes are aggregated. They comprise, in fact, a length of track equivalent to a double line from Dover to Glasgow. The London and North Western scheme covers 42 miles of route, and over 100 miles reckoned as single track. The London and South Western proposals are in two sections. The first, which is to be begun at once, covers 24 miles of route, embracing 73 miles of single track, while the second, which is to be taken in hand later, amounts to 62 miles of route, or 173 miles of single track. The London, Brighton, and South Coast Company are about to start the electric equipment of 34 more miles of route, embracing 150 miles of single track. A considerable proportion of the routes have either three or four tracks, and sidings to be electrified are also included. The total route length to be electrified by these three companies is thus 162 miles, and the single track length over 500 miles. If we add some short railways belonging to other companies which are now under construction or equipment, and other short electric railways authorised but not yet begun, having a total length of about 18 miles, we get in all 180 miles of route. The length of the routes of electric railways now in operation in the London district is approximately 135 miles, so there is thus in prospect a total length of electric railways in the metropolis and its outskirts of no less than 315 miles. The single track length approximates to 1,000 miles. The equipment work includes laying conductor rails, except in the Brighton Company's case, where overhead wires are employed. It also involves big contracts for cables, and the building and equipping of two large power-stations and the enlargement of a third, meaning the provision of steam and electric plant to the extent of something like 75,000 KW. There is thus an encouraging amount of railway electrical engineering work in prospect for the immediate future. Moreover, other railway companies will probably be induced to follow the example and electrify their city and suburban lines.

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BRIGHTON RAILWAY ELECTRIFICATION.

IMPORTANT EXTENSIONS OF SINGLE-PHASE SYSTEM.

The board of directors of the London, Brighton, and South Coast Railway Company having, as stated in the half-yearly report, decided to proceed with the equipment of the whole of their suburban system comprised within the area extending from London to Croydon, Purley and Coulsdon, and from London and Sutton to Cheam, active steps are now being taken towards the execution of the work. The board stated that they arrived at this decision after long and careful investigation of the conditions governing the suburban traffic, in view more especially of the excellent results obtained from the limited electric service now running, and of the steady growth of the competition for this traffic by other means of transport. The services on this system have been operated electrically for over three years.

Previous to the development of electric tramways in the southern district of London, 8,000,000 passengers per annum were carried over the South London line. The result of opening the London County Council electric tramways was, that by 1908, this number had shrunk to something like 3,000,000, with a consequent diminution in the revenue of the railway company, and with little or no compensation in the reduction of working expenses. The introduction of electric traction on this section resulted in the number of passengers not only being brought back to that originally carried by steam, before the competition of electric tramways first started, but in the increase of about 2,000,000 passengers, making a total of about 10,000,000, with corresponding increase in revenue. Little or no alteration in the fares was made when electric traction was introduced, so that the increase in receipts was practically proportional to the increase in passengers.

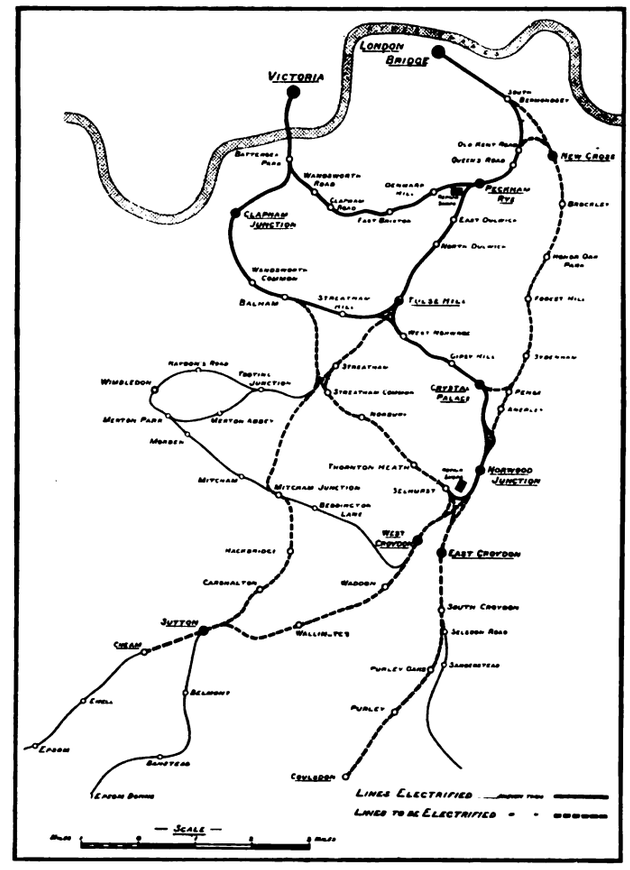
On the Victoria and Crystal Palace line competition has not been felt so severely, both in consequence of the distances being longer and of the tramway and motor omnibus services not having been so extensive in this region as in the area served by the South London line. At the same time, the increase during the first 18 months of service has been most remarkable, and there is no doubt that, before coming to such an important decision, the directors must have fully satisfied themselves as regards the increase in traffic brought about by electrification.

Attention is justly called by the directors to the fact that in the ever-increasing competition, which is only just commencing in the outer circle of the suburban area, motor omnibuses run to Purley, giving a service which does not exist on the railway with the present steam services. The directors must certainly have also had in mind the fact that by the almost entire suppression of steam on the whole of their suburban system, considerable reduction in locomotive expenses must necessarily follow, whilst it is hardly possible that with the limited electrification at present in operation any such economies can be effected.

The sections to be electrified comprise four tracks between Balham and Croydon and the Bricklayers' Arms (just north of New Cross) and Croydon, three tracks between London Bridge and Bricklayers' Arms, four tracks from Croydon to Purley, the remaining sections being two-track roads. The extent of electrification so far carried out, including all sidings, expressed in miles of single track, at the present moment amounts to 70 miles. The section now proposed to be electrified, reduced to single track and including sidings, will amount to nearly 150 miles, thus bringing up the total electrification to 220 miles, which will constitute by far the largest electrification ever undertaken by any railway company in this country. The present electrical rolling stock consists of 50 motor coaches, and in round figures another 200 motor coaches will be required to operate the extensions.

The supply of electric energy from the London Electric Supply Corporation has proved so satisfactory that it is intended to purchase from this company all the electricity required for working the suburban system, which will require the installation of additional plant of something like 40,000 to 50,000 KW., thus making the station of the London Electric Supply Corporation at Deptford, including its present output one of the, if not the, largest power-station in this country.

The principal reasons which influenced the Brighton Company in adopting the single-phase system were the desirability in their opinion of not having a third rail, and their conviction that in the near future it



Electric Lines of the Brighton Railway.

would be necessary to extend the electrification as far as Brighton and Eastbourne. As regards the first reason, it is significant that this seems to appeal to almost every railway adopting electric traction, even when the overhead system is to be used in connection with continuous current. This is the more interesting, as it was the overhead construction which was especially attacked by the opponents of the single-phase system. The decision of the Brighton Company to extend this electrification and their satisfaction with the single-phase system only confirms the experience of the Prussian Government and of the New York, New Haven and Hartford Railroad, whose directors are now completing large and important extensions on the single-phase system.

The actual decision to proceed immediately with the completion of the electrification of the whole of their

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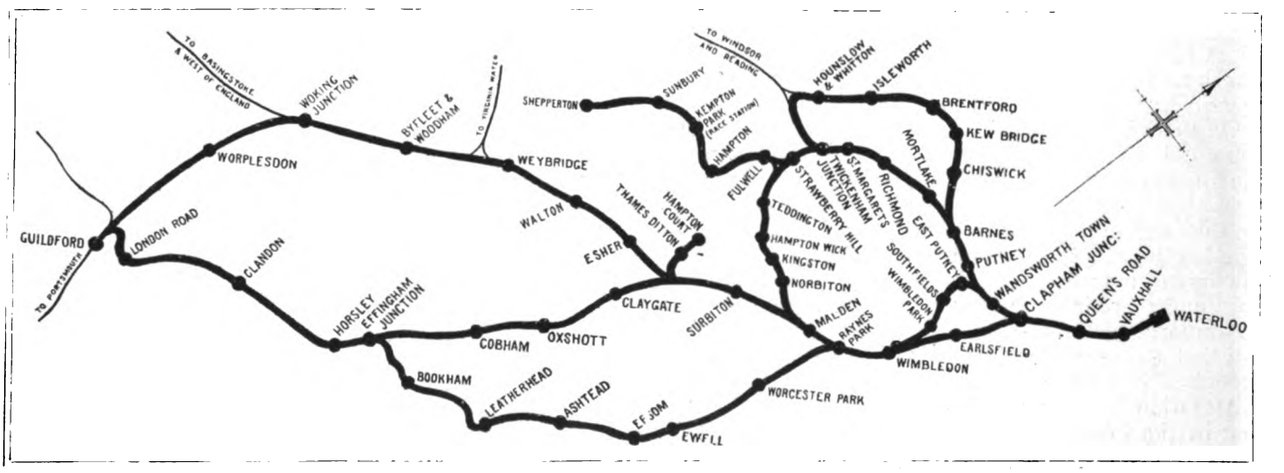
suburban system, after three years' practical experience, is certainly a landmark in the history of railway electrification, and the fact that the whole of that extensive work is expected to be completed within four years shows that all the plans and details are complete, so that the actual work can be started at once. It is greatly to the credit of the board and officials of this company that they have decided to adopt the "forward policy," thus making the company by far the most important pioneers in the development of electric traction amongst the great railways of this country, and congratulations are due to their consulting engineer, Mr. Philip Dawson, upon the success which has already been attained, and which will no doubt be increased as the system is extended.

ELECTRIFICATION ON THE LONDON AND SOUTH WESTERN RAILWAY.

Third-Rail Direct-Current System.

While the Brighton railway is proceeding, as described above, to extend their single-phase system, the London and South Western Railway, as already announced in these columns, is about to undertake an extensive electrification scheme on the direct-current system on its London and suburban lines. The routes to be dealt with are shown on the accompanying map, and it may be useful to recapitulate here briefly the plans so far as particulars are yet available, although they were set out in some detail in our issue of December 6.



Lines to be Electrified—London and South Western Railway.

The first route to which electricity will be applied is the circular line from Waterloo by way of Clapham Junction, Wimbledon, Kingston, Twickenham, and Richmond, back to Waterloo again, and also the connecting link with the existing electric line between East Putney and Wimbledon. This involves the conversion of 73 miles of single track on about 24 miles of route. The other portions of the scheme to follow will add a further 173 miles of single track, but it will be some time before these further extensions can be put in hand. The South Western Company will provide its own power supply, and will erect a power-station with a capacity of 25,000 kilowatts. Sub-stations will be provided on the first stage of the work at Clapham Junction, Raynes Park, Barnes, Twickenham, and Kingston, and the existing generating station at Waterloo will form another. The line will be worked on the direct-current system with a pressure of 600 volts.

INTERCHANGEABLE BRAKE SHOES.

A brake shoe that can be used on either side of the truck—right or left hand—merely by inverting it is a feature that is gaining favour amongst numerous tramway managers. It means interchangeability throughout the truck. The old standard form of shoe had the lug located just below the centre of the shoe; the shoe heads or holders were designed accordingly. With the interchangeable shoe the lug is placed centrally of the shoe, and the shoe holder redesigned to take this brake shoe, which can be transposed from right or left hand at will.

Brill Interchangeable Brake Shoe.

The Brill Company have recognised the simplicity of this feature, and have redesigned their shoe holders to accommodate this interchangeable brake shoe.

The illustration shows the interchangeable brake shoe fitted into the Brill half-ball brake shoe holder. As is well known, this half-ball hanger device is now standard on Brill trucks, and they have anticipated the trend in brake shoe design by redesigning their patented brake hanger holder to accommodate this new design of shoe. The patented half-ball brake hanger is an exclusive Brill fitting, and the added advantages of the interchangeable brake shoe in its design brings it still further in line with advanced ideas and practice.

When one reflects, storing two forms of brake shoes (right and left hand) represents considerable waste of immediate capital. A ton of right hand shoes and another ton of left hand shoes purchased practically means 50 per cent. capital lying idle in storage; there is further the vital question of storage space. The interchangeable brake shoe economises vastly in both directions, and we look forward to the not far distant date when the interchangeable brake shoe will be a standard fitting.

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A NEW MOUNTAIN RAILWAY IN THE TYROL.

In November, 1910, the old aerial ropeway on the Kohlererberg stopped running. It was originally intended solely as a goods line, with timber supports for the carrying ropes, but at a later date permission was also received for the conveyance of passengers. In spite of its primitive construction, and the lack of catch and safety appliances, the traffic was extremely heavy, but, although no accident is on record, passenger traffic had to be stopped on account of these defects.

The owner, Mr. Josef Staffler, Bozen, however, immediately decided to install a new and more efficient aerial line on the best and most perfect system existing to provide a convenient service for the constant stream

A Wire-Rope Railway in the Tyrol.

of visitors to the country under the shadow of the Schlern, Rosengarten, and Ortler.

The new Kohlerer line, which has been completed by the wire ropeway works, Ad. Bleichert and Company, Leipzig and London, in a little over a year, starts behind a bridge on the Eisack, and runs over 12 strong iron supports to the top of the Bauerkohlern. The difference in level between the two stations is about 2,755 ft., and the length of the line about 5,250 ft. Each of the cars, which are equipped with numerous catch, brake, and safety appliances, will carry 16 persons. Strong double steel wire ropes serve as track, and double traction ropes, which are electrically driven from the upper station, are used as propelling medium. Ample provision in the form of signalling and telephone appliances is provided to connect the two stations and to furnish means of communication between these and the cars.

ON THE SELECTION OF A RAIL GRINDER.

By J. F. Simpson
(*General Manager, Preston Corporation Tramways*).

To the manager or engineer in charge of the permanent way, the subject of rail grinding provides cause for a considerable amount of anxious thought. No matter how well the track may have been laid in the first instance there comes a time when the joints show unmistakable signs of "hammering," the points and crossings ask for attention in no uncertain tone, and the roar and rattle of the cars provides the manager with an excuse for propounding still another theory of "corrugation."

There are quite a number of methods of dealing with hammered joints; some engineers are content to fill up the hollows with new metal by the oxy-acetylene process, others adopt a more drastic remedy and cut out the offending joints altogether, but all the methods involve subsequent grinding to level up the rail face. Wear on points and crossings takes the form of grooves on the floor of the casting, and these again can only be removed by grinding.

For the removal of corrugations a rubbing or filing action is probably better than a revolving grinder, and experience has proved that a spare car fitted with emery or carborundum blocks meets all ordinary requirements. Such an arrangement is, however, quite unsuitable for levelling up joints or taking out grooves in crossings, and for such purposes some form of revolving grinder is essential. Several machines of this type are now on the market, all designed on the essential principle of a grinding wheel or wheels driven by an electric motor or petrol engine, but there is a wide divergence in the means used to apply the wheel to the work, and a correspondingly wide difference in efficiency. A long experience of grinding machinery of various types for tramway and other purposes leads the writer to suggest that when choosing a machine special consideration should be given to the following points:

(1) *Portability.*—It should be possible to carry out the grinding operations in daylight and without undue interference with the ordinary traffic. The machine should, therefore, be so designed that it may be easily and quickly removed from the track.

(2) *Power.*—Quick operation necessitates heavy cuts, and the motor should be of ample capacity, certainly not less than 4 B.H.P.

(3) *Rigidity.*—"Chattering" and vibration are fatal to good work, and to obviate them it is necessary that the wheel should be supported in a rigid frame with suitable gear for bringing it up to the work and regulating the depth of cut. There are other points of minor importance, such as the provision of some means of trueing the wheel *in position;* all grinding wheels wear out of truth after a short period of use, and should be trued up immediately to the angle corresponding with the tread of the rail.

The grinder should be supported on a truck with a fairly long wheel base and with wheels on *both* rails.

Machines running on one rail only, are more or less unsatisfactory, owing to the difficulty in keeping the machine upright, and the "barber's brush" arrangement of a wheel on the end of a flexible shaft is useless, as it is quite impossible to grind a flat surface with an unsupported wheel.

In conclusion it may be said that a grinder is a necessity on every tramway; the old adage, "A stitch in time saves nine," applies with special force to permanent way repairs, and a suitably designed and correctly proportioned machine will save its cost in a very short time.

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PECKHAM LONG WHEEL BASE TRUCKS.

In a previous issue we fully described some long wheel base trucks designed by Mr. Edgar Peckham, the inventor of the well-known Peckham tramway trucks, and supplied by the Peckham Truck Company to the Southend Corporation. Since that time the Brush Electrical Engineering Company, Limited, have supplied the Southend Corporation with three double-decked cars, 22 ft. 6 in. body and 32 ft. over all, mounted upon Peckham single-axle radial trucks with 13 ft. 6 in. wheel base and 22 ft. spring base (Fig. 1). They have also supplied the Corporation with four double-decked cars, 17 ft. 6 in. body, 27 ft. over all, mounted upon Peckham P-22, 8 ft. wheel base pendulum-geared trucks, as shown in Fig. 2.

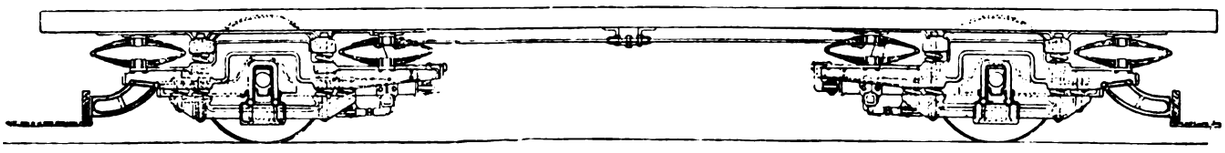

Fig. 4.—Peckham Single-Axle Radial Truck for Long Cars (over 13 ft. Wheel Base).

Both types of these trucks embody certain improvements not incorporated in the radial and pendulum trucks which have been running at Southend for the past two years. The radial trucks under the 22 ft. 6 in. cars have an improved design of roller bearings and centre gearing which gives a freer movement to the radial action of the axles, and enables the wheels to follow the curves with a minimum of friction. The axles are connected by centre bars so arranged with cross bars as to receive mechanical track brakes in case their use should be found desirable. The improvements embodied in the pendulum trucks in the 17 ft. 6 in. cars are shown in Fig. 2. They have steel side frames and a modified form of pendulum gear that requires much less space than the older type in use at Southend, is much stronger, and enables independent trusses to be used for supporting the ends of the car body. Fig. 3 shows the pendulum truck as constructed with solid forged side frames as supplied to Coventry and Barking Corporations.

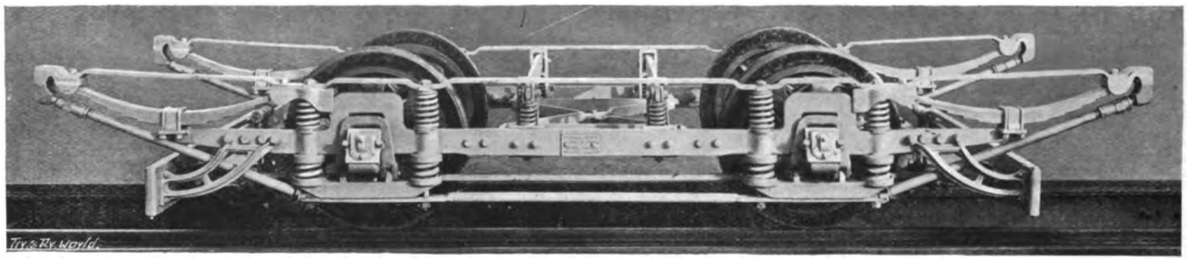

Fig. 3.—Peckham 8 ft. Wheel Base Pendulum Truck.

The Peckham single-axle radial truck, constructed as shown in Fig. 4, is intended to take the place of two bogie or maximum traction trucks in general use under long cars. It can be made with any desired wheel base up to 20 ft. Its advantages over maximum traction trucks are that it has 35 per cent. greater traction, a more powerful and effective brake, requires 30 per cent. less current, supports the car sills for 8 ft. at each end instead of 1 ft. centre support provided by the maximum traction truck, and costs 50 per cent. less to maintain.

Mr. R. Birkett, general manager of Southend Tramways, speaks in the highest praise of the operation of these trucks. He says they ride nicely without side swings or galloping, that they take the 45 ft. radius curves smoothly without grinding, that the single-axle radial trucks ride fully as well as the maximum traction trucks under the same length of car body, and that they brake much better, and the records show that they consume 30 per cent. less current. The wheels of the radial truck that has been in service for a year and a half have worn down evenly, and have not required machine turning, as have the wheels of maximum traction trucks. As a pair of Peckham radial trucks (for one car) have only four wheels instead of eight, the saving in the cost of maintenance of wheels alone must be large (Mr. Peckham claims 50 per cent., and that the general cost of maintenance of his radial and pendulum trucks, as demonstrated at Southend and West Ham for over two years, is 50 per cent. less than the cost of maintaining rigid-geared trucks). In addition to the improvement in gears and brakes, the Peckham trucks are equipped with the Peckham patent dust and oil-tight axle boxes that ensure cool axle journals and prevent waste of oil (Fig. 5).

The Peckham Truck Company, have now received an order from Messrs. Balfour, Beatty, and Company for 24 sets of pendulum gears for fitting to new cars ordered from the United Electric Car Company for the Nottinghamshire and Derbyshire Tramways. The trucks will be of the standard solid-forged four-wheel type with 8 ft. wheel base, which with the application of the pendulum gears will give an effective wheel base of 10 ft. Doncaster Corporation have ordered a Peckham single-axle radial truck with 13 ft. 6 in. wheel base, similar to those at Southend.

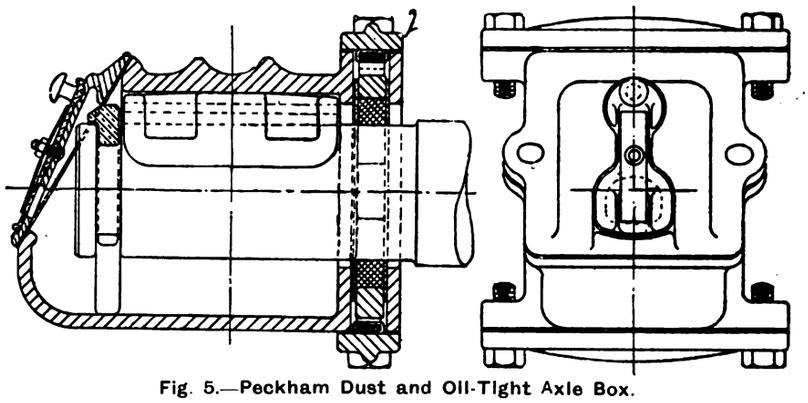

Fig. 5.—Peckham Dust and Oil-Tight Axle Box.

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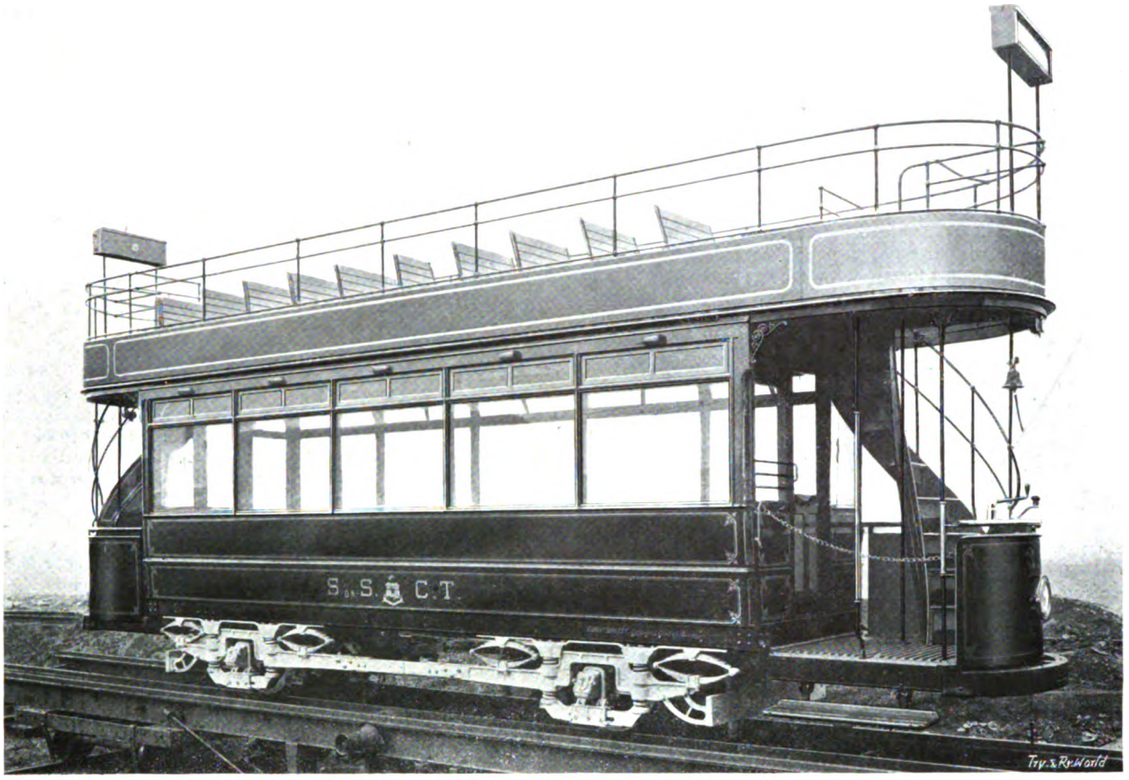

Fig. 1.—Long Double-Deck Car on Peckham Single-Axle Radial Truck with 13 ft. 6 in. Wheel Base and 22 ft. Spring Base.

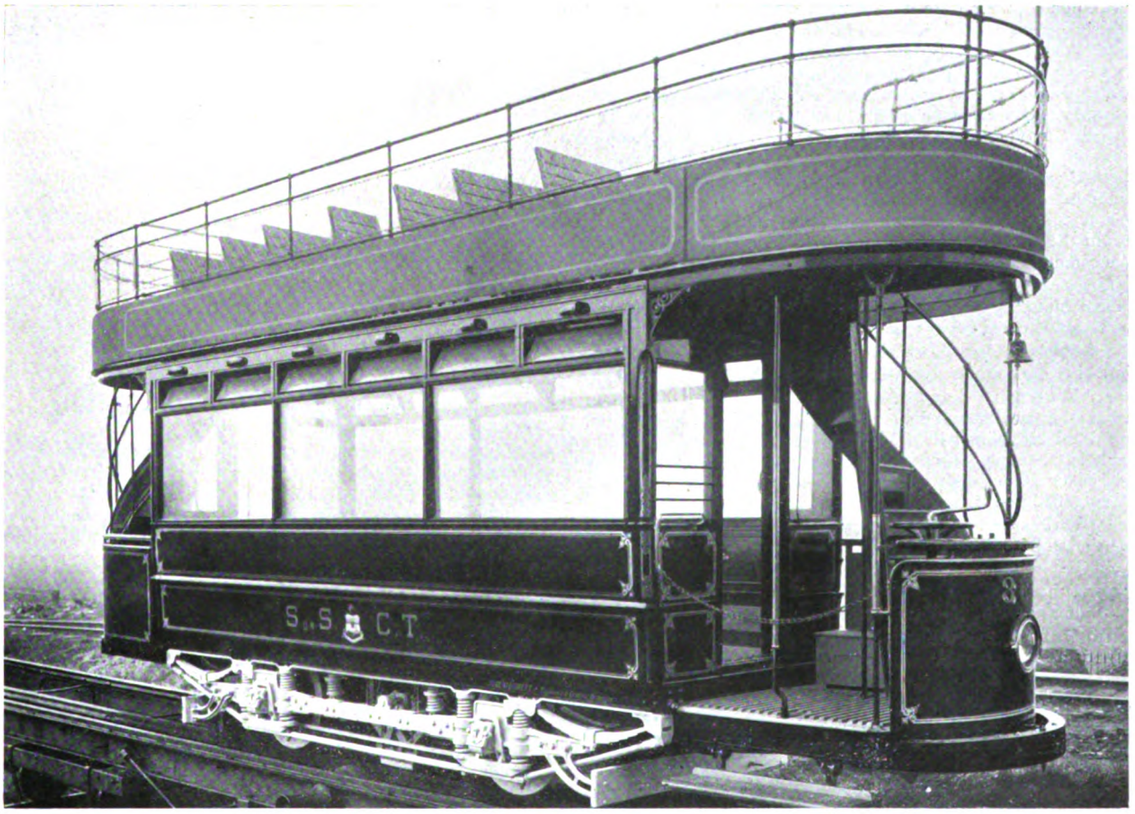

Fig. 2.—Double-Deck Car on 8 ft. Wheel Base Pendulum Truck.

CARS OF SOUTHEND-ON-SEA CORPORATION MOUNTED ON PECKHAM TRUCKS.

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COMMUTATING POLE MOTORS.*

By M. Eisig
(*Manager of the Chemnitz Municipal Tramways*).

The question of the adoption of commutating pole motors for tramway service has already been considered on two occasions by the German Union of Tramways and Local Railways—the first time in 1909, at its twelfth general meeting at Hamburg, and again at its thirteenth meeting at Berlin.

The reports were then submitted by Mr. Lehrmann, who dealt, however, exclusively with the results of German concerns. It was, therefore, thought opportune to extend the inquiry to the International Tramways and Light Railways Union, in order to ascertain what had been the experience of other undertakings. This extended inquiry has, unfortunately, not produced as large a number of replies as might have been expected; in fact, only 10 communications from non-German companies have been added to those who reported to Mr. Lehrmann. But, although not very numerous, the further replies received contain, nevertheless, sufficient information to render them worthy of being thoroughly examined. As might be expected, the German undertakings have not been able to supply much new information nine months after the publication of Mr. Lehrmann's report, which dealt with the subject in a very thorough manner, and may even now be regarded as still possessed of real value. The principal points in this report may be summed up as follows:

(1) The number of commutating poles is of no importance if the commutating field produced is sufficiently intense.

(2) The weakening of the field may be greater with interpole motors than with ordinary motors, hence the possibility of increasing the number of full-speed positions by using, independently of the running position with full excitation, one or two running positions in series and parallel, with a weakened field. The advantage of this arrangement consists in the ability to diminish the number of running positions on the rheostats, the last running position corresponding to the maximum speed provided, and to work permanently at reduced speeds.

(3) The question whether the motor must be calculated for supplying its normal power under maximum excitation or for a weakened field, is not yet definitely solved.

(4) As regards the maintenance and duration of service of commutators, the replies received differ to such an extent that no clearly defined conclusion can be drawn from them; the good results obtained by companies which, on abandoning the ordinary motors in favour of commutating pole motors, have retained the same power of motor, or even made use of a reduced power, prove, however, the advantage of the new motors. From the figures supplied by these undertakings it is shown that the commutators now require cleaning only after an appreciably longer time than formerly (from two to fifty times longer). Turning down the commutator is not required even after a period equal in length to the possible duration of service in the case of ordinary motors. From the facts thus ascertained it may be inferred that the life of the commutator is longer.

(5) With equal power of the motors, the life of the brushes of commutating pole motors may be taken to be from one and a half to four times greater than that of ordinary motors.

(6) It has not been possible to ascertain with any certainty the influence of commutating poles on the durability of the windings.

(7) We need not fear that the closing and opening of the circuit when the cars pass over section insulators, overhead switches, or insulated crossings will bring about any prejudicial effects if the coils of the commutating poles are not too small. Their inductive resistance is, in fact, sufficient to prevent the production of any dangerous intensities.

(8) Ordinary motors can work without inconvenience under tensions up to 750 volts; but it is probable that they will not behave so well as commutating pole motors.

(9) It has not yet been established with any certainty that commutating pole motors result in a saving of electric energy.

(10) It has been found disadvantageous to use the weakening of the field for braking, because the excitation is defective and slow, and because the armature is endangered by the sparks at the brushes. The advantage offered by commutating pole motors as regards braking only becomes obvious, in respect of the production of sparks at the brushes, when braking is resorted to in case of danger, that is to say at high running speed. This advantage is of special importance from the point of view of a safe service.

(11) From the data supplied no certain conclusions can be drawn in regard to the influence electric braking has on the heating of the motor.

(12) As compared with their advantages, the inconveniences of commutating pole motors are few; they are heavier than the ordinary motors, they have their parts less detached, and the cost is higher. The increased weight, however, is of no importance if no modification is made in the construction and weight of the frame. In regard to the cost, we must consider whether the additional price is not compensated by the advantages offered by the commutating pole motors. With only few exceptions the concerns interested are of opinion that this is certainly the case.

We will now consider whether the replies received from non-German sources, and the facts ascertained by the German sources and the facts ascertained by the non-German undertakings since the inquiry in 1911, and the conclusions arrived at in Mr. Lehrmann's report, are still correct, and, especially, whether it is not now possible to give an answer to the questions that are left undecided in that report.

As regards the number of commutating poles, two out of the nine non-German companies which answered the list of questions have motors with two and motors with four commutating poles. One of the undertakings in question holds the view that the conditions of commutation are more favourable in the case of four poles than in the case of two poles. In the former case the interval between two successive cleanings of the commutators is, as compared with the interval required for ordinary motors, six times longer, whilst it is three times longer in the second case. On the other hand, the second system, which has a particularly large number of cars equipped with commutationg pole motors, has not noticed any difference between the working of motors with four and those with two commutating poles.

Mr. Lehrmann's conclusion, according to which the number of commutating poles produces no influence as long as the field is sufficiently strong, requires, therefore, no modification.

Only three of the nine systems in question make use of the weakening of the field, while, strange to say, the others do not use this process, which has become almost general in Germany for regulating the speed. Two of the three companies which do use it have fixed the normal power of the motors for full excitation, and one for reduced excitation. The question whether it is better to over-excite the motors and fix the normal power for reduced excitation has not been elucidated by the companies, nor does it seem to have been decided by the manufacturers. As is known, if the motors are wound so as to produce their normal power—and consequently the normal field—for reduced excitation, their adjustment range is increased: this undoubtedly entails an advantage.

One manufacturer, moreover, points out that this method of winding may be regarded as preferable in cases where the lines to be served contain only few steep gradients, and if the distances between stopping places are comparatively long; the more pronounced heating to which the induction coils are subject at the start can then be dissipated during a prolonged running period, under a light charge.

Another manufacturer indicates as a disadvantage of this arrangement the fact that, on the one hand, the field intensity obtained in electric braking and, on the other hand, the motor tension, are uselessly increased in consequence of the over-excitation of the motor. If electric braking is used for normal braking, the motors must therefore be conditioned so as to produce their normal power with full excitation.

The practical observations made by the non-German companies in regard to the working conditions of the commutators agree, on the whole, with those stated in Mr. Lehrmann's report. Most of them state that the commutating pole motors work almost free from sparking, which is not the case with the ordinary motors. Some of them, however, emphasise that spark production is also very feeble in the case of ordinary motors of recent construction.

In regard to the question how frequently the commutators require cleaning and turning down, the replies received from the companies in question differ as much as those sent in by the German companies. With one single exception, they are, however, unanimous in estimating that the intervals between turning down the commutator are at least one and a half times longer for commutating pole motors than for ordinary motors. It is quite natural that they have not yet been able to express an opinion on the duration of the commutators, because the interpole motors only came into use a few years ago, and in the case of many companies, even after several years' service, no turning down of the commutators have yet become necessary.

The non-German systems also confirm Mr. Lehrmann's conclusion in regard to the life of the carbon brushes; only two of them say that they have not noticed any difference in this respect as compared with the duration of the brushes of ordinary motors, nor have they any data for appreciating the influence of commutating poles on the durability of windings. The sudden closing of the circuit, after cars have passed over section insulators, etc., may have injurious consequences in this sense that the jerk of current is not produced on the excitation coils, but on the shunt resistance arranged parallel to the motor, with the result that the field is not formed quickly enough; this phenomenon is of no consequence if the current interruptions are short, as is generally the case with tramways. In fact, generally speaking, no

* A paper presented at the Congress of the International Tramways and Light Railways Union, at Christiania, July 2-5, 1912, and specially translated for The Tramway and Railway World.

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deterioration has been observed, at least in regard to tensions of 500 to 600 volts at present in use. However this may be, it will be well not to allow section interrupters over which the cars have to pass under current, as for instance on ascents, to be passed, except in the first running position, that is to say, without weakening the field.

In the case, however, of a tension of 1,000 volts it was found, as is shown by a German company, that the sudden closing of the circuit might lead to inconveniences requiring the adoption of special measures in order to protect the motor. For this purpose experiments have been made with an arrangement which, in the case of sudden current interruptions, opened the shunt current circuit and only closed it again automatically after the current in the main field had reacquired a certain intensity.

Three non-German companies have carried out special experiments in order to determine whether the use of commutating pole motors result in a saving of electric energy. One of them did not observe any; the second noted a saving of 2½ per cent., and the third of 10 per cent. Of these three systems, the third alone applies regulation by weakening the field. Having regard to the little additional information received, it would not seem prudent to come to any conclusion whatever as to the superiority of commutating pole motors in this respect. It seems preferable to refer on this point to the abundant documentary evidence in Mr. Lehrmann's work and to abide by his conclusion, viz., that it has not yet been possible to determine with any certainty whether commutating pole motors effect a saving in electric energy. However this may be, it may be disputed that the commutating pole motors are in this respect superior to ordinary motors of recent construction, and of equivalent efficiency. If under identical conditions the former result in a saving of energy as compared with the current consumption of ordinary motors, such saving can only be attributed to certain advantages derived from better conditions of regulating the motors.

In regard to the important question of electric braking also very little can be said. Out of the nine non-German companies six only use this process for emergency braking, two for service braking, and one partly for emergency braking and partly for service braking, but only in case of danger. In common with most of the German concerns, these systems show a certain hesitation in making use of the motors for braking purposes. Nevertheless, the superiority of the interpole apparatus is confirmed by eight of the non-German concerns, the commutator being maintained in better condition and the sparking tendency being less.

One only of the non-German concerns uses the weakening of the field for braking, and it does not furnish any special information on the subject. As is known, the interest attached to the weakening of the field, when braking, is due to the fact that, if we do not weaken the field, the tension may, on acting abruptly, rise to an excessive degree. The great intensities thus produced give rise to very pronounced sparking at the brushes, which may easily cause the destruction of the spider winding of the armature. If, on the other hand, we weaken the field, tension is reduced and the armature escapes the danger indicated. On the other hand, it has been shown by careful experiments that the weakening of the field has this disadvantage that it renders braking less effective, and for this reason this method has not so far become general.

One German company, however, supplies information relating to some experiments it has recently carried out for the purpose of correcting the defect of the system. The process consists in adding to the equipment a contact device which acts automatically in such a way that the shunt winding is only put in circuit when the motors are suitably excited and when the current intensity amounts to an intensity of some 25 amperes. At the moment of braking the motors are therefore not shunted, and excitation takes place under normal conditions. A few moments later shunt occurs and prevents the production of excessive tensions. As at the time when this report was written the plant with which the experiments were made had only been working for a few weeks, it was not possible to form an opinion as to its value as regards regular and safe working.

One company has undertaken careful experiments concerning the influence which the application of electric braking may have on heating the motor; it has had observations made on several lines on the working of the equipments used successively, during a whole day, with electric braking, and then without braking. It was thus ascertained that, in the case of electric braking, the heating was from 5 deg. to 15 deg. C., more pronounced according to how the trains were made up (trail cars being used at times) and according to the character of the line served. On lines with varying gradients the greatest difference is noticed for motor wagons working separately. In trains made up of motor and trail cars the maximum difference is from 50 deg. to 80 deg. C., whatever the nature of the line served. These differences probably find their explanation in the fact that trains containing attached trail cars absorb more current at the start than motor cars alone, whilst the intensities are equivalent when braking. Unfortunately, the experiments in question were only carried out on ordinary motors, although of recent construction. We are entitled to suppose that under identical conditions commutating pole motors would behave more favourably in regard to heating. There is, however, a total lack of experience on this point, and the observations made during the regular service cannot give any positive indications. It is therefore not yet possible to determine whether commutating pole motors are really superior to the ordinary motors in regard to heating caused by electric braking. Nor have we any useful data to show how the latter may affect the cost of maintenance of the motors.

To sum up, it appears that the various questions connected with the use of commutating pole motors have not so far been elucidated and still await final solution.

The only advantages we may regard as clearly established are the following:

(1) With the addition of commutating poles it is possible to reduce excitation to a greater extent than is possible in the case of the ordinary motors, and, consequently, the speed of motors provided with interpoles can be modified within wider limits than that of ordinary motors.

(2) The wear and tear of the commutators is less; the operations of cleaning and turning down need not take place so frequently; and the length of life is thus extended.

(3) The life of the brushes also is longer.

(4) By using commutating pole motors, it becomes possible to make use of greater line tensions than those which are possible in the case of ordinary motors.

(5) With the sparking tendency less pronounced, commutating pole motors offer greater safety than do ordinary motors in electric braking, particularly in cases of danger.

To conclude, it appears that we must be satisfied with verifying whether these advantages are sufficiently great to induce tramway companies to replace their ordinary motors with commutating pole motors, and to make up for the disadvantage of the latter in that they are more expensive, heavier, and of less detached construction.

This question is answered in the affirmative by all the companies with the exception of two, one of which disputes nearly every advantage of commutating pole motors, whilst the other considers them to be useless for tensions of 500 or 600 volts used in the working of tramways.

RAILLESS ELECTRIC TRACTION.

ABERDARE.—Messrs. W. Griffiths and Company, London, have begun the construction work in connection with the railless traction installation for Aberdare. The first sod was cut near the Aberman Colliery by Miss M. Hughes, in the presence of a large crowd. The cost of the scheme will be £50,000, and it will provide communication between the town and the outlying districts. This will be the first installation of the Cedes-Stoll system in this country.

BLOEMFONTEIN.—After inspecting various systems of urban locomotion in England, Mr. G. A. Stewart, Bloemfontein city engineer, has reported that a railless trolley car service over five miles of main thoroughfare might be regarded as a sound proposal, but that if the scheme were made to cover 11½ miles of thoroughfare, as suggested, it would almost certainly involve a loss. Mr. Stewart recommends a motor omnibus service for the outlying parts.

BRADFORD.—The Tramways Committee have decided that the portion of Queen's Road extending from Valley Road to Manningham Lane be equipped for railless trolley vehicle traffic for the purpose of making a trial of the experimental Mercédès-Stoll railless trolley vehicles.

DUNDEE.—On the suburban route which has been fitted up for railless trolley traction, the receipts occasionally reach 25·3d. per car-mile run by each car. The Tramways Committee are considering a scheme for an extension from Hilltown to Lochee village, a distance of 1 mile 560 yards, at a cost of £1,000 for overhead equipment, and £700 each for two cars. Mr. Fisher, the manager, has reported that the railless cars are working as efficiently as the ordinary tramway service. While he doubts whether the proposed extension would pay at first, the traffic in time would become a paying one.

MEXBOROUGH.—A number of local authorities have agreed to oppose the Railless Trolley Bill promoted by Mexborough and Swinton Tramways Company, and to consider the advisability of themselves establishing a service of trolley vehicles for the districts of Barnsley, Wombwell, Ardsley, Wath, Darfield, Great Houghton, and Bolton-on-Dearne.

RAMSBOTTOM.—The chairman of the Council has reported that a deputation had inspected the railless system which has been working quite satisfactorily at Rotherham since October last. They met a representative of the R.E.T. Construction Company, and several suggestions which they made with respect to the cars were adopted. They had been promised that the cars would be delivered in the course of two or three months, and he thought they could count on having the cars running in about four months. The Council accepted the tender of the R.E.T. Construction Company for the supply of four cars, and that of Clough, Smith, and Company, for the supply and erection of the overhead equipment.

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TRAMWAYS AND LIGHT RAILWAYS.

BOARD OF TRADE RETURN.

The annual return of the Board of Trade relating to street and road tramways and light railways was issued on January 14. The report includes particulars relating to 290 undertakings, 172 of which belong to local authorities, and 118 to companies or other parties. It shows that the number of passengers carried in the year 1911-12 was equal to about 69 times the estimated population of the United Kingdom. The total capital expenditure on 2,637 miles of lines open for traffic was £77,377,390, and the number of passengers carried during the year 3,127 millions. Of the total mileage, 1,777 miles of line are owned by local authorities, and all but 206 miles of this are worked by the authorities themselves. The return also mentions the five miles of trackless trolley route worked by the Leeds and Bradford Corporations. The figures show an increase in mileage worked by electric traction of 40 miles. The net receipts of municipally worked tramways amounted to £4,233,874 on the year's traffic, and of this sum £1,247,908 was applied to the reduction of tramway debt, while £488,509 was paid in relief of rates. The balance, £975,504, was carried to reserve and renewals funds. The return shows that in 22 cases it was necessary to obtain aid from the rates to meet some part of the charges for the year. The total sum thus obtained was £62,032, as compared with £68,055 in the previous year. The net receipts from all tramways amounted to £5,801,648.

TABLE I.—STATISTICS OF REPRESENTATIVE PERIODS.

	Electric Period.		Steam Period.	Horse Period.
	1911-12.	1910-11.	1898.	1879.
Miles of route open	2,637·05	2,597·11	1,064·19	321·27
Total number of passengers	3,127,318,732	2,907,177,120	858,485,542	150,881,515
Number of miles run by cars	323,354,389	310,494,243	90,593,716	19,418,373
Capital expenditure per mile of single track open:				
Lines and works	£13,623	£13,534	£7,770	£7,840
All items	£18,005	£17,873	£10,469	£9,877
Percentage of net receipts to total capital outlay	7·50	6·97	6·38	3·97
Do. to net capital outlay (eliminating amounts expended on construction or purchase of old lines and works now superseded)	8·15	7·60	Not available.	
Percentage of working expenditure to gross receipts	60·60	61·70	79·93	83·81
Passengers carried per mile of route open	1,183,620	1,119,389	806,703	469,641
Passengers carried per car-mile	9·67	9·36	9·48	7·77
Average receipts per passenger	1·079d.	1·089d.	1·23d.	1·84d
Number of horses	1,579	1,880	38,777	10,958
Number of locomotive engines	31	32	589	17
Number of cars (electric)	12,435	12,120	5,335	1,610
Ditto (non-electric)	509	589		
Board of Trade units used	548,695,979	516,241,612	—	—

TABLE II.—GENERAL COMPARATIVE RECORD.

	1878.	1886	1894.	1900.	1902.	1903-4.	1906-7.	1910-11.	1911-12.
Total capital expended	£4,207,350	£12,573,041	£14,388,698	£21,735,988	£31,562,267	£46,451,444	£64,092,091	£75,672,826	£77,377,390
Miles of route open	269	865	975	1,177	1,484	1,840	2,394	2,597	2,642*
Number of horses	9,222	24,535	30,528	37,481	24,120	15,353	7,378	1,880	1,579
,, of locomotives	14	452	564	558	388	249	148	32	31
Number of cars	1,124	3,440	4,179	6,410	7,752	9,468	11,746	12,709	12,944
(of which were elec.)	—	—	—	—	—	7,132	10,369	12,120	12,435
Passengers carried	146,001,223	384,157,524	616,972,830	1,065,374,347	1,394,452,983	1,799,342,673	2,454,807,487	2,907,177,120	3,127,318,732
Units of energy used	—	—	—	—	—	211,112,476	369,362,473	516,241,612	548,695,979
Gross receipts	£1,099,271	£2,630,338	£3,615,837	£5,445,620	£6,679,291	£8,604,884	£11,849,175	£13,777,001	£14,726,068
Working expenses	£868,315	£2,021,556	£2,859,050	£4,075,352	£4,817,873	£5,602,774	£7,363,762	£8,500,941	£8,924,420
Net receipts	£230,956	£608,782	£756,781	£1,370,277	£1,861,418	£2,912,110	£4,485,413	£5,276,060	£5,801,648

* Including five miles of railless trolley line.

TABLE III.—MUNICIPAL AND COMPANY UNDERTAKINGS.

	1894.	1900.	1902.	1903-4.	1906-7.	1910-11.	1911-12.
NO. OF UNDERTAKINGS:							
Owned by municipalities	37	70	118	162	179	174	172
Owned by companies	116	107	115	150	139	122	118
ROUTE LENGTH (miles):							
Municipalities	316	585	886	1,148	1,571	1,744	1,782
Companies	660	592	598	692	823	853	860
SINGLE-TRACK LENGTH:							
Municipalities	497	936	1,465	1,915	2,637	2,972	3,028
Companies	814	830	871	984	1,212	1,261	1,275
CAPITAL EXPENDITURE:							
Municipalities	£3,887,534	£10,203,604	£18,910,467	£28,060,524	£41,735,547	£51,147,236	£52,644,616
Companies	£10,501,164	£11,532,384	£12,651,800	£18,390,920	£22,356,544	£24,525,590	£24,732,774

TABLE IV.—ROUTE LENGTH OF DIFFERENT SYSTEMS.

Year.	Electric.		Steam.		Cable.		Gas Motors.		Horse.		Mixed.		Total.	
	M.	Ch.	M.	Ch.	M.	Ch.	M.	Ch.	M.	Ch.	M.	Ch.	M.	Ch.
1902	870	58	156	35	25	8	9	51	384	6	37	75	1,483	73
1903	1,258	33	140	22	30	18	9	45	333	59	—		1,772	17
1903-4	1,462	1	108	58	29	70	4	2	235	22	—		1,839	73
1904-5	1,780	31	90	37	26	29	4	2	209	78	5	46	2,116	63
1905-6	1,993	48	71	72	25	52	4	2	144	65	—		2,239	79
1906-7	2,195	4	64	50	25	52	4	2	104	76	—		2,394	24
1907-8	2,286	10	52	32	27	41	4	2	94	13	—		2,464	18
1908-9	2,360	31	48	57	28	45	4	2	84	24	—		2,525	79
1909-10	2,428	61	41	79	28	45	4	2	58	24	—		2,561	51
1910-11	2,466	75	41	79	28	45	4	2	55	48	—		2,597	9
1911-12	2,517	62	41	79	25	45	4	2	47	56	—		2,637	4

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In summing up the return, the Board of Trade remark that, although there is a small increase in the rate of capital expenditure per mile of route open, an increase in the number of passengers carried per route-mile and per car-mile, coupled with a decrease in the ratio of working expenditure to gross receipts, improves the net receipts to such an extent as to afford a better percentage on capital outlay than was shown in the return for the previous year.

Table I. gives a few totals, ratios, and percentages for the last two years, in comparison with the typical "steam" period (*i.e.*, a period in which the use of steam power on tramways was at its maximum) and a typical "horse period":

A View of British Tramway Development.

For the purpose of presenting in convenient form some indication of the development of tramways in the United Kingdom, we have compiled Tables II., III., and IV. from the Board of Trade returns of past years. These tables give in condensed form a great deal of information, and show the growth of the business. Table II. goes back to the earliest year, 1878, for which information has been found available. Years selected at various intervals follow, and the period of maximum growth of the electric system is illustrated by the years being taken at more frequent intervals. The great increase in the figures for 1903-4 arises partly from the fact that from that year onwards light railways laid on streets and roads are included, while before 1903 only lines coming under the Tramways Act were embraced in the returns. The return for 1903-4 was also the first of the reformed series which takes into account the fact that electric traction had become a dominating feature. From that year onward the number of electric cars as apart from cars of all sorts is stated separately. So also we have the number of Board of Trade units of electrical energy used. The table shows the extraordinary advances under the heads of capital expenditure, mileage open, cars, passengers, receipts, expenses, and net receipts. At the same time the advance of electric traction is indicated by the falling off since 1900 in the numbers of horses and locomotives used.

Table III. is not carried back beyond the year 1894. That was about the period when local authorities began the process of buying up the undertakings of tramway companies. From the earliest days some tramways were owned by municipalities but were leased to companies, as under the Tramways Act, 1870, local authorities were not authorised to work tramways. By 1894, however, the Corporations of Blackpool, Huddersfield, and Plymouth were working their tramways under special statutory authority. After that, as purchase went on, power was at the same time acquired to carry on municipal operation. It is interesting to note that in spite of purchase going on, the number of undertakings owned by companies increased till 1903-4, and that the number at the latest date is practically the same as it was 18 years before. The track length of these undertakings belonging to companies has, however, in the same period increased by about 50 per cent. The track length of municipally-owned tramways increased by about 600 per cent. These increases compare curiously with the respective increases in capital expenditure. The municipal capital expenditure is about 14 times as much as it was in 1894, while the companies' capital expenditure is about two and a half times as much. No doubt some part of the actual total expenditure is included in the returns twice over, as some of the municipal capital went to buying tramways, the original cost of which was included in the returns from the companies.

Table IV. shows since 1902 (the earliest year in which such information was published) the length in miles of route of tramways worked by the different motive powers. The constant and overwhelming advance of the electric system is readily seen, as well as the steady decline in steam and horse traction. What there is of the cable system has remained comparatively steady.

As for the future, the era of a rapidly expanding mileage of electric tramways is probably over. Developments will be more gradual, just as districts gradually grow in population. But the Board of Trade returns for the next few years are likely to show a rapid growth in mileage of trackless trolley routes, which will penetrate districts where the traffic is not sufficient to warrant the construction of tramways. In the present return the trackless trolley system appears for the first time. It accounts for the modest figure of five miles of route, and this length is included in the total for 1911-12 in Tables II. and III. It is not included in Table IV., and a seeming discrepancy of five miles is thus explained.

Anger Automatic Brake Adjuster.—This device, which is manufactured by Mr. George Herman Anger, of Strand Road, Preston, was recently examined by the Board of Trade while on a car in actual service on a corporation tramway, and after a thorough examination permission was given for its use in electric traction; and the manufacturers inform us that they are authorised to refer to the Board of Trade any tramway authority interested in this device, and permission will be given for its use. This device is now in use on over 40 systems in England alone, and the makers have orders from Ceylon, Shanghai, Osaka, Melbourne, Adelaide, Johannesburg, Cape Town, East London, and other foreign places, as well as many other tramways in the British Isles.

THE LIGHT RAILWAYS ACT AS PASSED.

The following is the text of the Light Railways Act in its final form as passed by Parliament. The original numbering of the clauses has been altered in consequence of the striking out of the original clauses 2 and 12.

Power of Board of Trade to submit Order to Parliament, 59 & 60 Vict. c. 48.

1.—(1) If any Order under the Light Railways Act, 1896 (in this Act referred to as the principal Act), is not confirmed by the Board of Trade on the ground that the proposals of the promoters ought to be submitted to Parliament in pursuance of subsection (3) of section nine of the principal Act, the Board may, if they think fit, submit the proposals to Parliament by bringing in a Bill for the confirmation of the Order.

(2) If, while a bill confirming any such Order is pending in either House of Parliament, a petition is presented against the Order, the bill, so far as it relates to the Order, may be referred to a Select Committee, or, if the two Houses of Parliament think fit so to order, to a Joint Committee of both Houses, and the petitioner shall be allowed to appear and oppose as in the cases of private bills.

(3) On bringing in a bill under this section for the confirmation of an Order the Board of Trade shall make a special report to Parliament with respect to the Order.

Extension of Limit on Amount Available for Special Advances.

2.—The sum of seven hundred and fifty thousand pounds shall be substituted in section six of the principal Act for two hundred and fifty thousand pounds as the limit of the amount which may be expended for the purpose of special advances under that Act.

Reference to Light Railway Commissioners of Applications for Advances under the Development and Road Improvements Funds Act, 1909, 9 Edw. 7., c. 47.

3.—In the case of an application for an advance under Part I. of the Development and Road Improvement Funds Act, 1909, for the purpose of a light railway in Great Britain by any body or person other than a Government department, the Light Railway Commissioners shall, for the purposes of section four of that Act, be taken to be the Government department concerned, and accordingly the application shall be sent by the Treasury under that section to the Light Railway Commissioners, to be by them referred, together with their report thereon, to the Development Commissioners.

Power to Modify s. 92 of 8 & 9 Vict. c. 18, or as respects Scotland, s. 90 of 8 & 9 Vict. c. 19.

4.—Notwithstanding anything contained in section eleven of the principal Act, provision may be made by an Order under the principal Act for varying section ninety-two of the Lands Clauses Consolidation Act, 1845, or section ninety of the Lands Clauses Consolidation (Scotland) Act, 1845, as incorporated in the Order in such a manner as to provide for the taking of part only of a house, building, or manufactory, except where it is shown to the authority to whom the question of disputed compensation is submitted that that part cannot be severed from the remainder of the property without material detriment thereto, but no such provision shall be made unless the Light Railway Commissioners are satisfied that special notice of the proposal to acquire part only of the house, building, or manufactory has been given under paragraph (*b*) of subsection (2) of section seven of the principal Act to the owner, lessee, and occupier of the house, building, or manufactory.

Miscellaneous Amendments of Principal Act.

5.—(1) The requirement contained in paragraph (*b*) of subsection (2) of section three of the principal Act that the expenditure of a Council shall in a certain case be limited by the Order shall be amended by the substitution of the words "such amount as the Board of Trade think fit under the circumstances," for the words "such amount as will in the opinion of the Board of Trade bear due proportion to the benefit which may be expected to accrue to their area from the construction or working of the railway."

(2) There shall be substituted for the words "a railway company existing at the time will construct and work the railway if an advance is made by the Treasury under this section" in subsection (1) of section five of the principal Act, the words "a railway company working raliways open for traffic has entered into an undertaking, subject to an advance being made by the Treasury under this section, to work the light railway when constructed."

(3) The following paragraphs shall be substituted for paragraphs (*c*) and (*d*) of section eleven of the principal Act:

"(*c*) giving the necessary powers for constructing and working the railway and any works incidental thereto, including power to make agreements with any railway or other company, or any authority, person, or body of persons, for the purpose; and

"(*d*) giving any railway or any other company or any authority, person, or body of persons, any power required for carrying the Order into effect; and"

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(4) In subsection (1) of section sixteen of the principal Act a reference to an application for an Order under that Act shall include a reference to an intended application for such an Order, and a reference to parishes shall include a reference to parts of parishes.

(5) It is hereby declared that the fixed period referred to in subsection (4) of section sixteen of the principal Act need not be a period fixed by the Order, but may be a period fixed as occasion requires by the Board of Trade or other Government department.

(6) Notwithstanding anything in section sixteen of the principal Act, any expenses incurred by the Council of a borough with reference to the application for a Light Railway Order, or in pursuance of such an Order, may be made payable either out of the borough fund or rate, or as expenses incurred in the execution of the Public Health Acts as the Order may prescribe.

Amendment of Section 24 of principal Act as to Amending Orders.

6.—Where a Light Railway Order authorising the construction of a light railway on public roads empowers any local authority to acquire the railway, and an application is made under the principal Act by any local or road authorities in whose area any part of the railway is situate for an Order amending the original Order, the amending Order may, notwithstanding anything in proviso (*c*) of section twenty-four of the principal Act, determine or vary the authorities by whom the railway may be acquired, and may provide for the maintenance, management, and working of the railway when acquired under the Order, and may make such further provisions as are necessary for giving full effect to the Order:

Provided that the provisions of the original Order relating to the period within which the right of acquiring the railway must be exercised, and to the basis on which the purchase money is to be assessed, shall not be altered by the amending Order without the consent of the owners of the railway.

Winding-up of the Light Railway Company on Sale of Undertaking.

7.—Where, on the application of any company incorporated by an Order under the principal Act, it is shown to the satisfaction of the Board of Trade, either by statutory declaration or such other evidence as the Board consider sufficient, that the company have, owing to the sale of their undertaking or otherwise, ceased to be in a position to carry out the objects for which they were incorporated, the Board of Trade may, if they think fit, by Order declare that the company shall be wound up, and on any such Order being made the provisions of the Companies (Consolidation) Act, 1908, shall apply as if the company were a company within the meaning of that Act, and had resolved by special resolution that the company be wound up voluntarily.

Light Railway Commissioners as Arbitrators.

8.—(1) Any matter which, under any Light Railway Order, whether made before or after the passing of this Act, is to be determined by arbitration, shall be determined by the Light Railway Commissioners as arbitrators, if the parties make a joint application to the Commissioners for the purpose, and where under any such Order the Board of Trade have power to appoint an arbitrator for the determination of any matter, the Board of Trade may, with the consent of the parties, appoint the Light Railway Commissioners to be arbitrators.

(2) Where the Light Railway Commissioners act as arbitrators under this section, whether in pursuance of an agreement between the parties or of an appointment by the Board of Trade, the Board of Trade Arbitrations, &c., Act, 1874, shall apply as if the Light Railway Commissioners were appointed arbitrators by the Board of Trade in pursuance of a special Act, and the Arbitration Act, 1889, shall apply for the purpose of the determination of the matter by the Light Railway Commissioners as if the arbitration were pursuant to a submission.

Arbitration.

9.—(1) Subject to the special provisions of this Act with respect to the Light Railway Commissioners acting as arbitrators, any matter which under any Light Railway Order, made after the passing of this Act, is to be determined by arbitration shall, subject to any special provisions of the Order, be determined by the Board of Trade, or, if the Board of Trade think fit, by a single arbitrator appointed by them.

(2) The Board of Trade Arbitrations, &c., Act, 1874, shall apply with reference to the determination by the Board of any matter referred to them, and to the appointment of an arbitrator, as if this Act or the Light Railway Order were a special Act within the meaning of section 4 of the said Board of Trade Arbitrations, &c., Act, 1874.

(3) The Arbitration Act, 1889, shall apply for the purpose of the determination of any matter by an arbitrator appointed by the Board of Trade as if the arbitration were pursuant to a submission.

Continuance of Powers of Light Railway Commissioners.

10.—The powers of the Light Railway Commissioners under the principal Act shall continue for five years after the date of the passing of this Act.

Short Title.

11.—This Act may be cited as the Light Railways Act, 1912, and shall be read as one with the principal Act, and the principal Act and this Act may be cited together as the Light Railways Acts, 1896 and 1912.

THE DROPPED CLAUSES.

The following is the text of the original clauses 2 and 12, which were abandoned. They are not to be confused with the clauses which now, in consequence of re-numbering, become clauses 2 and 6 of the amended Bill:

Power of Light Railway Commissioners to Authorise Trackless Trolley Systems.

2.—(1)—A trackless trolley system along any road or street may, with the consent of the road authority of the district in which such road or street is situate, which consent shall not be unreasonably withheld, be authorised by Order under the principal Act in the same manner and subject to the same conditions as a light railway, and that Act and any Act amending the same shall accordingly be construed as if the expression "light railway" included a trackless trolley system:

Provided that any such Order shall contain provisions requiring the company, body, or person upon whom the powers thereof are conferred to pay the cost of any alterations or improvements in the road or street made for the purposes of, or rendered necessary by, the trackless trolley system, and to make a contribution towards the cost of maintaining the road or street, regard being had in determining the amount of such contribution to (amongst other things) the additional expense incurred by the authority by whom the road or street is maintained.

(2) The expression "trackless trolley system" means a system of running on roads or streets without any defined track or line of rails mechanically-propelled vehicles moved by electrical power transmitted thereto from some external source, and includes all apparatus necessary for working the system.

(3) Mechanically-propelled vehicles used for the purpose of any trackless trolley system authorised in pursuance of this section shall not be deemed to be light locomotives within the meaning of the Locomotives on Highways Act, 1896, or the by-laws and regulations made thereunder, nor shall they be deemed to be motor cars within the meaning of any provisions of the Motor Car Act, 1903 (except subsection (1) of section one of that Act and the provisions necessary for enforcing that subsection), and subject to that exception neither that Act nor the regulations made under that Act, nor the enactments mentioned in the schedule to the Locomotives on Highways Act, 1896, nor the Locomotives Act, 1898, shall apply to any such mechanically-propelled vehicles except in so far as they are incorporated or applied by the Order authorising the system:

Provided that—

(*a*) the dimensions and material of tyres of all such vehicles shall be regulated by the Order; and

(*b*) nothing in this provision shall affect any duties of excise (including the duties charged by section eight of the Locomotives on Highways Act, 1896) for the time being payable in respect of any such vehicles.

(4) Section forty-eight of the Tramways Act, 1870 (which applies to tramways certain enactments relating to hackney carriages), shall apply in the case of any mechanically-propelled vehicles used for the purpose of any trackless trolley system authorised in pursuance of this section in the same manner as it applies in the case of carriages used on a tramway.

(5) This section shall not apply to the County of London.

Inclusion of County Council as a Local Authority.

12.—The term "road authority" or "local authority" in this Act shall, as regards main roads vested in a County Council, include the County Council.

CORPORATIONS AND OMNIBUS MANUFACTURE.

At the statutory meeting of Nottingham Corporation, at which sanction was given to the promotion of a bill seeking powers to construct additional tramways and to run motor omnibuses, Councillor Harlow pointed out that section 10 empowered the Corporation to "provide, maintain, and equip, but not manufacture mechanically propelled vehicles," and section 18 said that the Corporation should not manufacture motor 'buses. When joint stock companies were registered they generally tried to get as many powers as they could. Section 13 provided that trolley vehicles might be used for the carriage of passengers and parcels, but section 20 gave power to provide accommodation for passengers and Corporation servants by erecting shelters and waiting rooms. Why should they not also provide accommodation for parcels in the waiting rooms? The town clerk replied that these were standard clauses, and Parliament had refused time and again to allow Corporations to manufacture.

Manufacturers and the Ghent Exhibition.—The exhibition branch of the Board of Trade is endeavouring to organise a national British collective display at the Ghent International Exhibition, 1913. The French and Belgian societies of motor manufacturers are arranging displays for their countries. According to the latest returns Great Britain holds third place in the sale of motor vehicles to Belgium. French firms do ten times as much business as British firms, whose exports to Belgium are also less than those of Germany.

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TRAMWAYS IN SOUTH AFRICA.

The following particulars relating to the several municipal tramways in South Africa, and the Cape Town, the Port Elizabeth, and the Kimberley Tramway Companies are extracted from "South African Municipal Year Book."

There are at present five municipalities in South Africa which own tramway undertakings, viz., Durban, East London, Johannesburg, Pietermaritzburg, and Pretoria. Of these five only two earned profits during 1911, viz., Johannesburg £45,187, and Durban £16,589. The Pretoria Electric Tramway was opened for traffic in November, 1910. The losses on the working of the other lines were comparatively trifling, and are more than compensated for by the great indirect profits accruing to the municipalities consequent upon the opening up of new districts by tramway communication.

The installation of railless traction systems in Bloemfontein, Boksburg, Benoni, and Germiston has been decided upon, and it is anticipated that the work will be commenced in each town this year.

In Cape Town, Port Elizabeth, and Kimberley electric tramways are in the hands of private companies. Through the courtesy of the town clerk of Port Elizabeth (Mr. Willoughby How, J.P.) and the general manager of the Cape Town Tramways and the manager of the Kimberley Tramways, particulars of the workings of these three lines have been furnished.

DURBAN CORPORATION TRAMWAYS.

Population (white and black)	69,165.
Tramways started under municipality	1892 and 1899.
Length of track	32·09 miles.
Length of street routes	18·43 miles.
Capital expenditure	£428,000.
Number of passengers carried (1911)	16,343,420.
Number of car-miles run	1,607,941.
Total receipts	£113,708.
Working expenses	£67,310.
Net receipts	£46,398.
Interest charges	£16,733.
Sinking fund (annual contribution)	£2,766.
Depreciation and reserve (annual contribution)	£7,560.
Accident insurance fund (annual contribution)	£1,000,
Contribution in aid of rates	£16,589.
Traffic receipts per car-mile	16·87d.
Operating expenses per car-mile	10·03d.
Electricity supplied by municipality or company	Municipality.
Number of Board of Trade units used during year	2,964,255.
Price paid per unit for energy	1·125d.
Hours of motormen and conductors per diem	9
Day's work from	10 hours minimum. 14 hours maximum.

Type of car—four-wheeled double-decked.
Number of passenger cars—77.
Other rolling stock—2 sprinklers, 2 funeral cars, 6 stone trucks; 1 sprinkler, bogie trucks, others four-wheeled.
Type of rail—girder.
Weight of rail—84 lb. per yard.
Type of joint—9 in. laminated copper bond; 60 lb. per pair eight-hole fish plates.
Overhead construction—centre pole and span wire.
Gauge of trolley wire—00.

EAST LONDON MUNICIPAL TRAMWAYS.

Population	Whites, 13,000, Coloured, 10,500.
Tramways started under municipality	January, 1900.
Length of track	5·9 miles.
Length of street routes	4·20 miles.
Capital expenditure	£52,246.
Number of passengers carried (1911)	1,679,391.
Number of car-miles run	245,996.
Total receipts	£13,506 16s. 1d.
Working expenses	£16,661 12s. 7d.
Net receipts	£13,506 16s. 1d.
Interest charges	£3,292 4s. 6d.
Depreciation and reserve (annual contribution)	£2,120.
Accident Insurance Fund (annual contribution)	£39 1s. 8d.
Traffic receipts per car-mile	13·18d.
Operating expenses per car-mile	16·25d.
Electricity supplied by	Municipality.
B.O.T. units used during year	327,993.
Price paid per unit for energy	3d.
Hours of motormen and conductors per diem	10.
Day's work from	6 a.m. to 11 p.m.

Type of car—Electric Construction Company, General Electric Company, and Dick, Kerr double-decked.
Number of passenger cars—15.
Type of rail—British Standard, section No. 3 and 3c.
Weight of rail—100 lb. per yard on straight, 106 lb. per yard on curve.
Type of joint—Thermit weld and fish plated.
Type of overhead construction—bracket arm and span-wire suspension.

JOHANNESBURG MUNICIPAL TRAMWAYS.

Total population (white and black)	220,012. 111,857 whites. (Only whites carried.)
Tramways started under municipality	July 1, 1904.
Length of track	56,989 miles.
Length of street routes	35,277 miles.
Capital expenditure	£744,538 5s. 4d.
Number of passengers carried (1910-11)	26,632,215.
Number of car-miles run	2,548,177.
Total receipts	£319,974 1s. 9d.
Working expenses	£196,413 10s. 3d.
Net profit	£45,186 19s. 11d.
Interest charges, sinking fund, depreciation, and reserve (annual contribution)	£68,776 9s. 11d.
Sundry deductions from gross profits	£8,597 1s. 8d.
Contribution in aid of rates	£45,186 19s. 11d.
Total receipts per car-mile	30 13d.
Total expenses per car-mile (including capital charges)	24·97d.
Electricity supplied by	Municipality.
Number of Board of Trade units used	5,777,261.
Price paid per unit for energy	2·05d.
Hours of motormen and conductors	9.
Day's work	10½ hours average.

Type of car—double-deck, four-wheeled, and bogie.
Number of passenger cars—109: 99 four-wheeled, 10 bogies.
Other rolling stock—5 trailers, 8 freight cars, 1 electric tower wagon, 1 petrol-driven tower wagon for running on track, 2 motor tower wagons.
Type of rail—Vignoles and grooved girder.
Weight of rail—56 lb. to 103 lb. per lineal yard.
Type of joint—fished.
Overhead construction—span wire, centre pole, and slde bracket.
Gauge of trolley wire—0000 B.W.G.

PIETERMARITZBURG MUNICIPAL TRAMWAYS.

Total population (black and white)	30,539.
Date tramways started under municipality	November 2, 1904.
Length of track	8½ miles.
Length of street routes	6¾ miles.
Capital expenditure	£133,340.
Number of passengers carried (1910-1911)	1,662,636.
Number of car-miles run	244,750.
Total receipts	£10,727.
Working expenses	£9,645.
Net receipts	£1,082.
Interest charges	£4,934.
Sinking fund (annual contribution)	£1,114.
Accident insurance fund (annual contribution)	2 per cent. of traffic revenue.
Contribution in aid of rates	Nil.
Traffic receipts per car-mile	10·004d.
Operating expenses per car-mile	9·458d.
Electricity supplied by	Municipality.
Board of Trade units used	279,202.
Price paid per unit for current supplied	1½d.

Type of car—double-deck.
Number of passenger cars—16.
Other rolling stock—1 sprinkler, 1 motor tower wagon.
Type of rail—girder and Vignoles.
Weight of rails—girder, 94 lb.; Vignoles, 58 lb.
Type of joint—Cooper rail joint.
Overhead construction—side running, bracket construction.
Gauge of trolley wire—000 S.W.G.

PRETORIA MUNICIPAL TRAMWAYS.

Population	24,720 whites; 16,910 coloured.
Tramways started under municipality	November, 1910.
Length of track	10 miles.
Length of street routes	8 miles.
Capital expenditure	£150,000.

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Type of car—single-deck convertible.
Number of passenger cars—21.
Type of rail—B.E.S. Co., Sec. 2.
Weight of rail—95 lb.
Type of joint - standard, with sole plates.
Overhead construction—non-fouling, centre pole.
Gauge of trolley wire—2/0.

CAPE TOWN TRAMWAYS COMPANY.

Population (white and black)	154,000.
Length of track	28 miles.
Length of street routes	20 miles.
Number of passengers carried (1911)	13,224,621.
Number of car-miles run	1,930,693.
Total receipts	£130,078.
Working expenses	£71,742.
Net receipts	£58,336.
Average traffic receipts per car-mile	16·171d.
Operating expenses per car-mile	8·92od.
Electricity supplied by	The Company.
Board of Trade units used	3,268,841.
Hours of motormen and conductors per diem	8 to 9 hours.
Day's work is performed	5-30 a.m. to 1-30 a.m.

Type of car—double and single-deck.
Number of passenger cars—78.
Other rolling stock—3 sprinklers, 2 stone wagons, 1 tower car.
Type of rail--groove girder.
Weight of rail—87 lbs.
Type of joint--fish plates and welded joints.
Overhead construction—underground and aerial feeders, bracket and span.
Gauge of trolley wire—1/0 and 2/0.
Type of trolley wire—round and grooved.

KIMBERLEY, BEACONSFIELD, AND KENILWORTH COMPANY.

Length of track	2½ miles electric, 3 miles horse traction.
Length of street routes	2½ miles.
Number of passengers carried (1910)	360,595.
Number of car-miles run	44,340.
Accident insurance fund (annual contribution)	Ocean Accident.
Electricity supplied by	De Beers Company.
Price paid per unit for energy	4d.
Hours of motormen and conductors per diem	10 hours.

Type of car—single-truck, open type, double-deck bogies.
Number of passenger cars—11 cars, 1 pic-nic van.
Other rolling stock—1 electric sprinkler.
Type of rail—Vignoles.
Weight of rail—65 lb. per yard.
Type of joint—6-bolt angle iron.
Overhead construction—7-strand steel span mechanical clip.
Gauge of trolley wire—3·000.

PORT ELIZABETH.

Total population	Say, 32,000
Tramways started	June 16, 1897 (privately owned).
Length of track	14 miles total single track; 4½ miles double.
Capital expenditure	Say, £180,000.
Number of passengers carried (1910)	3,250,000.
Number of car-miles run	467,000.
Total receipts	£32,000.
Working expenses	£20,500.
Net receipts	£11,500.
Traffic receipts per car-mile	16·44d.
Operating expenses per car-mile	10·53d.
Electricity supplied by	Company.
Hours of motormen and conductors per diem	Vary according to shifts.
Day's work is performed	Varies week by week.

Type of car and number—9 double-deck, 12 single-deck, Californian type, 8 convertible, 1 open.
Particulars of rolling stock—1 stone truck, 1 water car.
Weight of rail—81 lb. and 87 lb.
Type of joint—fish plate.
Overhead construction—usual aerial cables.
Gauge of trolley wire—0 and 00.

PRIVATE BILL ESTIMATES.

LARGE PROSPECTIVE EXPENDITURE FOR RAILLESS TRACTION SCHEMES.

Both Leeds and Bradford, the pioneers of the railless trolley car traction in this country, had prepared bills seeking to increase their installations. In the case of Leeds the estimated cost of additional tramways track and railless car electrical equipment is £43,646, while for tramcars and railless cars a sum of £22,500 is asked, together with £37,428 for land and a depot for tramcars and trolley vehicles. When the Leeds bill was submitted to the statutory meeting of citizens the clauses relating to superannuation for Corporation employees, tramways, and sewage were rejected, and at a subsequent meeting of the City Council the clauses were dropped, although the Labour members desired the retention of the tramway and sewage schemes.

Bradford is applying for £11,226 for three new railless routes. Various clauses of the bill have led to opposition from the citizens, but the Lord Mayor has refused to grant a poll of the ratepayers at an expense of £1,000, on the ground that the request presented to him was not in accordance with the Borough Funds Act.

Powers are asked to enable Brighton Council to take over the statutory authority granted to the local omnibus company two sessions ago to install a route to Rottingdean outside of the borough boundary. This is to be worked in connection with the routes which Brighton obtained power last session to construct. The estimated cost of establishing the system is £19,200. Chesterfield Council's estimates are £2,000 for car sheds, £6,400 for trolley cars, and £33,780 for equipment. Derby's estimate for a trolley car installation is included in a total of £30,000, which also provides for tramway extensions. Huddersfield sets down £4,300 for trolley vehicles in a £128,670 scheme for tramway extensions into the surrounding districts. Nottingham allocates £3,385 for tramways, £54,875 for trolley vehicles and motor omnibuses, and £8,775 for lands and buildings for car sheds. Morley Council propose to link up with Leeds by means of railless trolley cars, and West Bromwich Corporation propose an outlay of £20,000 on six routes. Railless trolley proposals by the London County Council in Hackney, Eltham, and Lewisham account for an estimate totalling £68,635. Southport Council propose an outlay of £8,500 on trolley vehicles.

Railless traction schemes by companies are five in number. Mexborough and Swinton Tramways put forward a £50,000 project. On formal grounds several local authorities are opposing this bill, and they propose later on to promote a bill for a railless traction scheme themselves. The Metropolitan Electric Tramways Company propose to link up the Middlesex and Walthamstow tramways by means of railless installations between Tottenham, Wood Green, and Walthamstow. The Western Valleys (Monmouthshire) Railless Traction Company has been formed with a capital of £135,000 to work trolley cars from Brynmawr to Newport; and the Folkestone, Sandgate, and Hythe Tramways Company are asking for leave to abandon the surface-contact or underground systems of traction to which they are bound for the construction of tramways in those towns and to substitute railless trolley cars. Rhondda Tramways Company propose an installation from the tramway terminus to Llantrissant.

APPLICATIONS FOR MOTOR OMNIBUS POWERS.

Motor omnibus applications by local authorities are numerous. The Chesterfield bill embraces an outlay of £16,000, Huddersfield £7,500, Halifax £11,000, Southport £2,000, Derby £5,000; and Morley Council include their estimate in the railless trolley figures already mentioned. West Bromwich put down £8,000 for motor 'buses, and West Bridforth £5,000. Barry Urban Council do not give the figures for their scheme. Coventry Corporation are applying for authority to expend £11,200 on the purchase of motor omnibuses, and £3,800 for the erection of garages, etc., and Southend Council desires £15,000 for the purchase of motor omnibuses.

TRAMWAY PROPOSALS.

New tramways of the London County Council are estimated at £544,820, street improvements £460,320, and subways, etc., £94,000. Halifax Council's estimates in connection with proposals for 12 miles of tramways are £147,738 for rails and track, £25,000 for electrical equipment and other works, £22,200 for rolling stock. The lines are to be in Brighouse and in the district of Halifax Rural Council as well as in the borough. Mainly owing to a street widening scheme estimated to cost £45,000, a poll of Halifax ratepayers resulted in 6,031 votes being recorded against the bill, as compared with 1,921 in its favour. The number of persons entitled to vote was 25,798. Another scheme for interurban lines is promoted by Huddersfield Corporation, in whose project Brighouse also figures. The total outlay is £128,670. Colne Council are purchasing the undertaking of the Colne and Trawden Light Railway Company, and they also apply for power to spend £10,000 on improvements of the undertaking, and to borrow £2,000 for working capital. Derby Council's proposals include new tramways to cost £30,000, and Leicester's estimates are £69,627 for construction and £11,812 for general purposes of the tramways. Nottingham's figures are £33,850. The Hastings and District Tramways Company propose to substitute overhead trolley traction for the surface-contact system on the sea front. East Ham Corporation seek to use trailer cars on the tramways.

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THE TRAFFIC PROBLEM IN MANCHESTER.

REPORT BY TRAMWAYS COMMITTEE.

Manchester Tramways Department issued on January 28 an interim report, prepared by Mr. J. M. McElroy, the general manager, at the instance of a special sub-committee appointed on November 14, 1911, to consider and report upon:

(1) The probable increase of tramway traffic during the next 20 years.
(2) The provision necessary to diminish the increasing congestion in the central streets, and for facilitating tramway traffic by the following or other means:
  (a) Widening of existing streets or the construction of new streets.
  (b) The acquisition of an arterial centre for the marshalling of tramway traffic.
  (c) The construction of subways for tramway traffic.
(3) The extent to which the financial resources of the tramway undertaking can be applied to this purpose.

Mr. J. M. McElroy, the general manager, and his staff were occupied for many months in obtaining information, and presenting it to the sub-committee in such a form as enabled them to see the extent of the problem they had to deal with The sub-committee reported that:

"The chief difficulty in dealing with the question of the traffic congestion lies in the insufficiency of good street accommodation in the heart of the city, and the bad layout of the city streets. These defects are common to most of the older cities, but Manchester is particularly unfortunate in this direction. The Corporation has for many years spent large sums of money in endeavouring to remedy this condition of things."

EFFECT OF CONGESTION ON CURRENT CONSUMPTION.

"The cost to the department of working the cars in the central area at the present low speeds is much greater than it would be if higher average speeds could be obtained. Take one item alone—current consumption. Experiments made by the department showed that on a typical route the current consumption in the congested central area was 2·26 units per car-mile, and in the suburban portion of the same route it dropped down to 1 39 per car-mile—a reduction of 38 per cent. It is estimated that if all the cars in the central area could be operated at an average speed of eight miles per hour, a saving of something like £20,000 per annum could be effected in the working expenses of the department.

"The Tramways Committee have taken many steps in the past to minimise the traffic congestion in the central area. They have constructed additional parallel routes, and have also utilised Stevenson Square, Albert Square, Parker Street, and George Street (behind the old infirmary) as tramway termini, and by this means traffic has been taken out of some of the more congested streets. The sub-committee must point out, however, that these are only temporary checks, and afford no permanent relief to the ever-growing volume of traffic entering and leaving the city along several of the main thoroughfares, such as Oxford Road, London Road, and High Street. The adoption of covered tops on the cars has lessened the increasing demand for more cars in inclement weather. If the tops of the cars had not been covered a largely increased service would have been necessary in the winter months. The construction of the circular routes has diverted traffic from entering the heart of the city, and has thus tended to reduce the congestion."

During the year ending March last over 174,000,000 passengers were carried, compared with 126,000,000 in the year ending March, 1905. The committee estimate that if these rates of increase are maintained during the next 20 years the total number of passengers carried on the two systems in Manchester and Salford in 1932 will reach 386,000,000. Should any radical change be made in the way of cheaper fares the increase in the number of passengers will be much greater. The reduction in fares on the Manchester system last year has already resulted in a large increase in the number of passengers carried, and it is estimated that the total increase for the financial year ending March 31 next will be at least 12,000,000, as against the average of 6,700,000 in previous years. The further reductions about to be made will bring the increase during the coming year much above the normal figure.

UNDERGROUND LINES—MANAGER AND ENGINEER TO VISIT OTHER CITIES.

The report concluded as follows: "The cost of widening existing streets and the construction of new streets will be enormous. The principal street improvements carried out in the central area since the year 1838, covering, as they do, so long a period as 74 years, cannot be said to be very extensive, yet the cost of such improvements was £2,365,669, and it would be safe to assume that if the same improvements had to be carried out at the present day the cost would be at least double that figure. The cost of constructing 'tube' railways and underground tramways is very great. It will, of course, vary in accordance with the local conditions, but as an illustration it may be pointed out that the tramway subway constructed under Kingsway, in London, cost £395,000 per mile.

"Many of the larger cities in various parts of the world have been confronted with a similar problem, and some of such cities have solved or attempted to solve the problem. In the sub-committee's opinion it is essential that the traffic conditions in those cities should be carefully studied, and a full report made thereon with a view to showing how far the solutions arrived at elsewhere are applicable to the conditions prevailing in Manchester."

The sub-committee express appreciation of the valuable assistance rendered by the general manager in the preparation of the report, and they add:

"His thorough grasp of the many phases of the problem, and his wide knowledge of all matters connected with the passenger transport business, have made his services of especial value to the Corporation in connection with this inquiry; and the sub-committee recommend that, prior to any deputation being appointed from the members of the committee to visit other places, the general manager and the permanent way engineer be instructed to visit certain cities in the United Kingdom and abroad, and to carefully study the traffic conditions of those cities, and to present a full report thereon for the further guidance of the sub-committee prior to their issuing their final report upon the several points remitted to them by the resolution of the committee."

THE B.E.A.M.A. DINNER.

The most interesting and successful gathering in connection with the electrical industry that has taken place in London for a long time was the dinner on January 26 of the British Electrical and Manufacturers' Association. Lord Ampthill presided, and about three hundred sat down to table at the Savoy. Among the company were many of the leading representatives of various branches of the industry. The growth of the Association both in numbers and influence during the past year or two has been remarkable, and the position which it now occupies was well indicated by the character of the proceedings. The electrical industry has long needed a greater spirit of co-operation, and the Association is to be congratulated on the harmonizing influence which it has already exerted. The report of the work of the Council, which has been published, shows clearly enough that it has already achieved a large measure of success, and it is now in a position to exercise a strong and beneficial influence which must be increasingly productive of good. The relations between sellers and purchasers of plant are being improved, and many questions that in the past have given trouble and been productive of unfair conditions are being disposed of in a way that augurs well for the future. Matters of considerable delicacy have from time to time to be dealt with; but it is gratifying that from all directions comes testimony to the skilful way in which the work of the Association has been directed.

The proceedings after dinner were of exceptional interest. Mr SAMUEL INSULL, president of the Commonwealth Edison Company, of Chicago, proposed the B.E.A.M.A. He felt that the greatest obstacle to progress in this country had been a lack of co-operation between makers of plant and suppliers of energy. Nothing would add so greatly to the prosperity of the electricity supply business of the United Kingdom as a greater appreciation on the part of those engaged in it of the true mission before them. In London alone, 200,000 H.P. was awaiting the attention of the electricity supply authorities. In the County of London, with a population of 7¼ millions, 750 million units a year were manufactured for all purposes; in Chicago, a population of 2¼ millions in 1912 consumed 800 million units. His message was that, if they wished to see their great industry prosper, the main thing necessary was the massing of the production and of the distribution of energy. The pursuit of that policy would bring prosperity to the Association.

Mr. A. BRUCE ANDERSON, chairman of the Council, in responding, said that in the words of "The Road Mender" all they asked was "leave to serve." The Association had achieved a position in which they expected to be heard—and so long as they spoke truly, they must be heard. Whenever they had found it necessary to speak, either on behalf of individual members or of the Association as a whole, they had invariably been received with courtesy and consideration. That position had been achieved by a reasonable growth of that spirit of alliance which they had grafted on to, without impairing, their old spirit of self-reliance, by the careful deliberations of the council and committees. It was also due to the splendid organising ability and tact of their secretary, Mr. Dunlop. They should be thankful to him and his staff. During the year they had obtained the services of Lord Ampthill as president of the Association; they regarded his presidency as a high honour, and a clear indication to their friends of the reasonableness of their desires and of the purity of their intentions. As the visitors by their presence recognised the importance of the Association, so the latter would recognise and endeavour to fulfil their obligations.

Mr. L. W. EVANS, M.P., in proposing "British Industry," referred to the prosperity of trade the world over, and said that the mainsprings of British industry were brains and capital, but closer co-operation between them was necessary. If we had that, we would not see capital provided from London, as was the case in the Rand power scheme, while the Germans got the work.

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Lord AMPTHILL, in reply, said he was a casual labourer in various branches of public work, and he could sympathise with those who did not share in the advantages due to the unquestioned boom in trade. They might well be proud of the achievements of British industry in the past, and thankful to Providence that these blessings had been showered on the nation. Their most urgent need was to see that all classes shared in their good fortune. Could they disregard the efforts of their rivals and go on in the same old way? Often in business a complete change of methods was necessary. Cobden thought we should always be the workshop of the world, but other nations had become workshops, and as they did not copy our methods as Cobden expected, we should adapt ourselves to their methods. The people looked after themselves by trade unionism, a system of co-operation to protect their interests; why not extend the system to the nation—why not have a federation of trade unions of the Empire? How could they reconcile the system of protection of labour with Free Trade in goods? Foreign manufacturers could protect themselves; British manufacturers should be able to compete with them, not for their own sakes, but for the sake of the workmen. He congratulated them on the wonderful success of the industry; by the skill of the workmen and the courage and devotion of the employers they had recovered their lost ground and pulled up level with their competitors. But they must not forget the 12 millions of people on the verge of starvation—the discontent of labour—the unmanly decadence which held back their citizens from preparing themselves to defend their great heritage. There was nothing like work to inculcate the spirit of duty and discipline and to bring about the social reforms that were so necessary. What was wanted above everything else was far-sighted promotion of British industry.

Dr. S. Z. DE FERRANTI, vice-president, proposed "Kindred Institutions and Our Guests," to which Mr. W. DUDDELL, president of the Institution of Electrical Engineers, and Colonel Sir N. J. MOORE, Agent-General for Western Australia, replied.

Mr. HUGO HIRST, vice-president, proposed the health of the Chairman (Lord Ampthill), who described himself as a casual labourer, but he would describe him as one of the unemployed, for, unfortunately, in this country we often sent our best men to debate in the House of Lords while the ship of State was drifting, and our industry was drifting with it. Lord Ampthill was willing to help them, and in their wider aims he would be of great assistance. The difference between commerce and industry was most marked. Commerce led to internationalism; industry to nationalism. No one now cared for the manufacturer. They must alter this condition, and organise a system of co-operation to combat the splendidly organised and greatly successful efforts of other countries.

The CHAIRMAN briefly responded, expressing his appreciation of Mr. Hirst's remarks.

THERMIT WELDING IN BRIGHTON.

Mr. Wm. Marsh, engineer and manager, Brighton Corporation Tramways, in the course of a description contributed to a local journal of the Thermit welding of the Old Steine tramway track, observed that "in Gloucester Place about two years ago the rails were renewed and the joints welded according to the latest and best practice; and although about three-quarters of a million cars have been over them since, there is not the slightest sign of a joint anywhere. Marlborough Place and Grand Parade were similarly treated; and where, from one end of the country to the other, can better track be found? I have often been asked, 'When you weld the joints how do you provide for expansion and contraction?' The answer is very simple: it is not necessary to provide for it at all. It is well known that in the case of railway rails expansion and contraction are very important factors which have to be taken into consideration; but in their case the conditions are totally different. The whole of a railway rail is exposed to the air, and in all probability its temperature on a hot day is above the temperature of the surrounding air. Tramway rails are completely buried except for their surface. Not only this, but they are attached to and kept cool by anchors which lie even deeper in the ground, and as a rule they have wood paving blocks on either side, wood being a good insulator against heat. The temperature of the ground a few inches below the surface does not vary to anything like the same extent as the temperature of the air. Hence the rails cannot vary very much either. The one thing which has to be provided against is contraction. A welded joint cannot break by expansion, but plenty of cases have been known where they have been broken by contraction. For this reason joint welding should be done in the winter, when the rails are at their minimum average temperature, or at any other cool time of the year when the diurnal change is slight. If rails with welded joints are exposed to a hot sun before the surface is paved, not only is there danger of the joints breaking afterwards by contraction, but the expansion and contraction at the time which take place before the concrete has properly set make the rails liable to work loose on their bed afterwards; and in consequence it is not possible to obtain such satisfactory results as can be obtained in cool or wet weather."

FINANCIAL REPORTS AND MEETINGS.

Sao Paulo Tramway, Light and Power.—The board have declared a dividend of 2½ per cent.

Mexico Tramways.—The directors have declared a dividend of 1¾ per cent. on the issued capital stock.

Canadian Car and Foundry Company.—The directors have declared a quarterly dividend of 1¾ per cent. on the preferred stock.

Clontarf and Hill of Howth Tramway Company.—The directors have declared a dividend of 3 per cent. per annum, £400 being carried forward.

Electric Construction Company.—The directors have resolved to pay an interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year ended November 30, 1912.

Lancaster and District Tramways Company.—The profits for the year ended September 30 were £813, and after paying interest on loans amounting to £809, there is a divisible balance of £2,370.

United Electric Tramways Company of Monte Video.—The directors have declared an interim dividend at the rate of 6 per cent. per annum (3s. per share) on the ordinary shares, for the half-year ended September 30.

Liverpool Overhead Electric Railway.—The directors recommend a dividend for the past half-year at the rate of 2½ per cent. per annum on the ordinary shares. A year ago 2 per cent. per annum was paid on the ordinary shares, and 1½ per cent. per annum at the end of 1910.

A Successful Year at Liverpool.—The tramway receipts for 1912 show another remarkable increase. The receipts from January 1 to December 28 amount to £625,163, as against £598,186 for 1911, an increase of £26,977. The passengers numbered 133,228,898, as against 128,206,669, an increase of 5,022,229. The mileage last year was 12,496,300, an increase of 141,968.

Dublin United Tramways Company.—The directors have declared a dividend for the half-year to December 31 at the rate of 6 per cent. per annum, less income tax, on both the preference and ordinary shares, after setting aside £10,000 towards the renewal of rails, £2,000 to accident insurance reserve, £5,000 to reserve and renewals fund, and carrying forward £11,257.

Chatham and District Light Railways.—The revenue for the past half-year was £23,976, and expenses £13,276, leaving a surplus of £10,700. Rent of Rochester Corporation lines absorbs £1,871, and interest charges £1,377. Including £2,141 brought forward, the divisible balance is £9,591, out of which £4,500 has been transferred to the reserve for depreciation, and dividends at the rate of 3 per cent. per annum on the ordinary shares, and at the rate of 5 per cent. on the preference shares are proposed, carrying forward £561.

Record Relief of the Rates at Liverpool.—The Tramways and Electricity Committee have adopted estimates showing that £97,000 will be available to the relief of the rates, a sum equal to a 6½d. in the pound deduction. £67,000 arises from tramway profits, as compared with £38,243 in the previous year, the balance of £30,000 being an increased percentage from the profits on electric power and lighting account, which 12 months ago yielded £25,000. The committee have reached the period when half of the tramway profits can be devoted to the rates, as compared with a third in previous years.

Buenos Ayres Lacroze Tramways Company.—The gross receipts for the year were $5,650,827, working expenses were $3,477,981, and the net receipts were $2,172,846. After deducting from the net earnings the amounts paid for amortisation and interest on debentures there remains a net balance of $1,696,089, which the directors propose to distribute as follows: 5 per cent. to the reserve fund, $79,959; 5 per cent. to the directors, $79,959; ½ per cent. to the syndic, $7,995; to fund providing for accidents, $11,454; to special fund for renovations, $36,801; to the shareholders, $1,125,000: and to next year, $24,917. For the preceding year the shareholders received $911,100.

Yorkshire (West Riding) Electric Tramways.—The operations of the past 12 months, after providing for all expenses, including repairs, maintenance and debenture interest, resulted in a net income of £20,106, which has been appropriated as follows: Dividend on 6 per cent. cumulative preference shares at 3 per cent. per annum, less tax, £6,534; depreciation, renewals, reserve fund in lieu of accident insurance, and general reserve fund accounts, £7,329; and the sum written off preliminary expenses account, £6,242. The number of passengers carried amounted to 9,787,444, and the miles run to 1,773,218, as against 9,640,027 and 1,785,696 respectively for the previous year.

Lanarkshire Tramways Company.—The report for the half-year ended December 31 gives the revenue as £41,909 and expenses £22,189, leaving £19,720. Contributions payable to local authorities were £852, interest on debentures £909, interest account £531, expenses in connection with Lanark County Tramways Act £818, and amounts written off (as per revenue account) £136, leaving a balance of £16,474. The balance brought forward was £5,200, making £21,674. Of this amount £9,500 has been placed to reserve for depreciation, and the directors recommend that the balance be disposed of as follows: £10,290 to

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TRAMWAY AND OMNIBUS SHARE LIST.

Specially Compiled for "The Tramway and Railway World."

Amount Ranking for Dividend.	Shares.	Name.	Div'd. Prev. Half-year.	Div'd. Last Half-year.	Quotations, Jan. 31.	Movement During Jan. Rise.	Movement During Jan. Fall.	Latest Business Done. Price.	Latest Business Done. Date.	Yield on Buying Price. £ s. d.	Dividend Due. (Final in Italics.)	Quotations, Jan., 1908, to Jan. 31, 1913. Highest	Quotations, Jan., 1908, to Jan. 31, 1913. Lowest
640,000	5	Anglo-Argentine Tramways 5½% Cum. 1st Pref.	2/9	2/9	4⅞—5⅛	+ ⅛	...	5	Jan. 31	5 7 6	Jan., Dec.	5 17/32	4¼
500,000	5	Do. do. 5½% Cum. 2nd Pref.	2/9	2/9	4⅝—4¾	...	...	92/6	Jan. 15	5 15 9	June, *Dec.*	5 11/32	4 1/16
1,500,000£	...	Do. do. 5% Deb. Stock Red.	5%	5%	98½—100½	+ ½	...	99½	Jan. 31	4 19 6	June, Dec.	105½	96
325,532£	Stk.	Auckland Elec. Trys. Co. 5% Mort. Deb. ..	5%	5%	101—103	...	...	102	Jan. 2	4 17 3	Jan., July.	107	101
75,000	1	Bath Electric Tramways 5% Cum. Pref. ...	6d.	6d.	11/16—13/16	...	...	14/6	Dec. 31	6 3 3	*Jan. & July*	15/16	7/16
334,696£	Stk.	Birmingham Dist. Pow. & Tract. 4½% 1st Deb....	4½%	4½%	89—91	...	...	91½	Dec. 17	4 19 0	Jan., July.	96	77
15,000	10	Blackpool and Fleetwood Tramways	4/-	9/-	14½—14½	...	...	14⅝	Dec. 18	4 9 9	Feb., Aug.	14½	12
60,000	10	Bombay Elec. Supply & Trys. Co. 6% Cum. Pref.	6/-	6/-	11—12¾	...	— ½	11⅞	Jan. 15	5 2 3	Feb., Aug.	12¼	7⅜
1,003,614	$100	Brazil Traction...	3	3	101½—103½xd	...	...	102½	Jan. 31	5 19 3	...	105¼	90¼
75,000	5	Brisbane Elec. Tramways Investment Co. Ord.	4/-	4/-	6¾—7¾	...	...	7 5/16	Jan. 29	5 8 6	*May*, Oct.	9½	3 5/16
75,000	5	Do. do. do. 5% Cum. Pref.	2/6	2/6	4⅞—5¼	...	...	5 1/16	Jan. 10	4 15 3	*May*, Nov.	5⅜	4⅜
50,000	10	Bristol Tramways and Carriage Co.	4	4	6¼—6½	...	— ⅛	5⅜	Nov. 9/10	6 3 3	*Feb.*, Aug.	14½	5
50,000	10	Do. do. do. 4% Cum. Pref.	4	4	7¼—7½	...	...	7	Sept. 30	5 6 9	Jan., July.	9¾	6¾
800,000£	Stk.	British Columbia Electric Railway Def. Ord. ..	8%	for '11	141—145	+ 1	...	144	Jan. 31	5 10 6	May, Nov.	156	123
800,000£	Stk	Do. do. Pref. Ord.	6%	6%	120—124	+ 2	...	121½	Jan. 31	4 16 9	May, Nov.	132½	105
800,000£	Stk	Do. do. 5% Cum. Perp. Pref.	5%	5%	105—108	...	— 2	107⅜	Jan. 31	4 12 6	May, Nov.	114	99
1,070,097£	Stk.	British Electric Traction Prefd. Ord.	...	...	10½—12½	...	— 1	11	Jan. 30	...	Apr., *Oct.*	16	10½
403,503£	Stk.	Do. do. 6% Cum. Pref. ..	6%	6%	87—90	...	...	87¼	Jan. 27	6 13 6	Feb., *Aug.*	95¼	86½
1,464,245£	Stk.	Do. do. 5% Perp. Deb. ...	5%	5%	91—95	...	— 1	92	Jan. 25	5 7 0	April, Oct.	101	82½
439,796£	Stk.	Do. do. 4½% 2nd Deb. Red. ...	4½%	4½%	77—81	...	...	77	Jan. 11	5 11 3	Jan., July.	84	58
246,625£	Stk.	Buenos Aires Port & City Trys. 6% 1st Mt. Deb.	6%	6%	91—95	...	...	95	Dec. 17	6 6 6	Feb., Aug.	103	61
623,270£	Stk.	Buenos Ayres Lacroze Trys. Stg. 5% 1st Mt. Deb.	5%	5%	99½—101½	...	...	100⅛	Jan. 30	4 19 0	Mar., Sept.	103	89
137,610	5	Calcutta Tramways Ord.	4/6	2/6	5¾—6¼	+ ⅛	...	6 1/16	Jan. 8	5 12 0	*Apr.*, Oct.	7¼	4
47,295	5	Do. 5% Cum. Pref.	2/6	2/6	4 13/16—5 1/16	...	...	5	Jan. 31	4 18 9	Jan., July	5⅜	4⅜
491,222	1	Cape Electric Tramways	1/-	for '12	⅜—¾	..	...	14/9	Dec. 4	6 13 6	Feb., *Nov.*	13/16	⅛
15,000	10	Carthagena and Herrerias Steam Tramways ...	5/-	for '11	2¾—3½	...	...	65/-	Nov. 21	...	April.	7	3
248,000	5	City of Buenos Ayres Tramways (1904) ...	2/6	2/6	5½—5¾	+ 1/16	...	5 11/16	Jan. 31	4 7 0	Fe.My.Au.No	6	5⅛
120,000£	Stk.	Colombo Elec. Trys. & Ltg. 5% 1st Mt. Deb. ...	5%	5%	93—97	...	...	96	Jan. 31	5 3 3	May, Nov.	101	87
11,500	10	Cork Electric Tramways and Lighting Co. ...	...	8/- ann.	4½—5	...	...	4 15/32	Dec. 23	8 0 0	*Mar.*	10	4½
12,327	10	Do. do. do. 5% Cum Pref.	5/-	5/-	7½—8	...	...	8	July 22	6 5 0	Jan., July	10¾	7½
3,000	10	Dublin and Lucan Elec. Railway 5% Cum. Pref.	5/-	5/-	8¾—9½	...	...	9	Aug. 25/10	5 8 3	Sep.15, Mar.15	9½	6
60,000	10	Dublin United Tramways Co. (1896), Ltd., Ord.	7/-	6/-	11¼—11¾	...	...	11 9/16	Jan. 30	5 10 9	Feb., Aug.	14	11
60,000	10	Do. do. do. 6% Cum. Pref.	6/-	6/-	12—13	...	...	12⅝	Jan. 29	4 12 6	*Feb.*, Aug.	14	11½
13,500	10	Gateshead & District Trys. Co. Ord.	7/-	5/-	8¼—8¾	...	...	8⅜	Sept. 27	6 17 3	*Mar.*, Sept.	9½	7⅞
268,235	10/-	Hastings and District Elec. Trys Ord.	...	...	1/32—3/32	...	...	1/9	Jan. 5/12	...	...	3/16	1/32
80,000	1	Do. do. 6% Cum. Pref. ...	6%	6%	⅝—¾	+ 1/32	...	12/6	June 6	8 0 0	...	⅞	13/32
125,000£	Stk.	Do. do. 4½% Deb. Stk. Red.	4½	4½	69—74	...	...	73¼	Feb. 8/12	6 1 9	April, Oct.	100	69
$9,634,000	$1,000	Havana Elec. Rly. Co. Con. Mort. 5%	5%	5%	99—103	...	...	100	Dec. 23	5 12 0	Feb., Aug.	105	80
195,000£	100	Hong Kong Tramways Co. 5% Mt. Deb. ...	5%	5%	86—90	...	...	87	Jan. 31	5 11 3	May, Nov.	92	75½
20,000	10	Imperial Tramways Ord.	Nil	Nil	4½—5½	+ ½	...	9¾	Oct. 29/09	...	Feb., Aug.	9¾	2¼
20,000	10	Do. 6% Cum. Pref.	Nil	Nil	8—8½	...	...	6 7/32	Ju. 28/09	...	Jan., July.	9½	2¾
30,000	5	Isle of Thanet Elec.Try.& Ltg. Co.5% Cum. Pref.	2/6	Dec. '12	2⅛—2⅜	...	...	46/3	Nov. 30	4 15 3	*Mar.*, Sept.	3	¾
250,000	1	Kalgoorlie Electric Tramways	...	...	5/32—7/32	...	...	1/-	Jan. 15/12	...	*May*	3/16	3/32
170,000	1	La Plata Elec. Trys. Co. 6% Cum. Pref. ...	7½d.	7½d.	29/32—1	...	...	19/9	Jan. 21	6 0 0	*April*, Oct.	1 1/16	¼
30,800	10	Lanarkshire Tramways	6/6	5/6	9¾—10¼	...	...	10	May 27	5 17 3	Feb., Aug.	10 9/16	9⅜
250,000£	Stk.	Lancashire United Trys. 5% Prior Lien Deb...	5%	5%	78—80	...	...	81½	Nov. 28	6 5 0	Jan., July.	95	79
634,026	1	Lisbon Electric Tramways Ord.	7½d.	7½d.	1 1/16—1 3/16	...	...	21/3	Dec. 11	5 1 3	*July.*	1 9/32	⅞
425,553	1	Do. do. 6% Cum. Pref ...	7½d.	7½d.	1 1/16—1 3/16	...	...	21/6	Jan. 20	5 1 3	Jan., July.	1¼	13/16
1,000,000£	Stk.	London General Omnibus 4½% 1st Deb.	...	...	94½—96½	+ ½	...	94½	Jan. 30	4 13 3	...	98	93¼
1,000,000£	Stk.	Do. do. 5% Cum. Income ...	...	...	92—94	+ 1	...	92¼	Jan. 30	5 6 6	...	94	90
125,000	10	London United Trys. (1901), Ltd., 5% Cum. Pref.	2/6	Dec. '08	5¼—5¾	...	...	5⅛	Dec. 5	...	*Jan.*, July.	8½	1⅜
63,430£	Stk.	Madras Elec. Trys. (1904) Ltd. 5% Deb. Red. ...	5%	5%	101—103	+ 3	...	96	Dec. 19	4 17 3	Jan., July.	102	86
300,000£	100	Manaos Trys. & Ltg. Co. 5% 1st Debs.	5%	5%	87—90	...	— 2	89	Jan. 24	5 11 3	Jan., July.	97	86
$4.785,000	$1.000	Manila Elec. R. R. and Ltg. Corp. 5% Gld. Bds.	5%	5%	100½—102½	...	...	102	Jan. 15	4 18 6	Mar., Sept.	104⅜	84
60,000	1	Mansfield & District Trys. Ltd. 6% Cum. Pref.	7½d.	7½d.	29/32—1 1/32	...	...	19/3	Sept. 5	5 16 6	Mar., Sept.	1 1/32	¾
395,832	1	Metropolitan Electric Tramways Ord.	7	5	1 1/16—1 3/16	...	...	21/3	Dec. 10	5 1 3	*April*, Oct.	1⅜	⅝
314,016	1	Do. do. do. Def.	...	...	...	...	...	4/9	Dec. 10	...	...	6/6	1/32
500,000	1	Do. do. do. 5% Cum. Pref.	6d.	6d.	¾—⅞	...	...	16/6	Dec. 12	5 14 3	*Feb.*, Aug.	1 1/32	11/16
$16.487,400	$100	Mexico Tramways Common Stock	$3½	$3½	110—112	...	— 1	110¾	Jan. 30	6 8 6	Fb.My.Au.No	151½	65
$3,840,000	...	Michigan Untd Rys. Co. 5% 1st Debs & Refdg Bds	5%	5%	93—95	...	— ½	93	Jan. 17	5 8 6	May, Nov.	101½	92¼
140,000£	100	Montreal Street Rly. 4½% Ster. Debs.	4½%	4½%	100—102	...	...	101	Dec. 2	4 10 0	Fe.My.Au.No.	107	99
5,000	10	Oldham, Ashton, and Hyde Elec. Tramways Ord.	7/-	5/-	6⅝—6⅞	...	...	6½	Oct. 8	8 14 6	Mar., Aug.	9⅜	6⅜
5,000	10	Do. do. do. 5% Cum. Pref.	5%	5%	6½—6¾	+ ⅛	...	6 1/32	July 8	7 8 3	Feb., Aug.	8½	6⅜
77,893	5	Para Elec. Rly. and Ltg. Co., Ord.	5/-	5/-	7½—8	+ ¼	...	7¾	Jan. 31	6 7 0	May, Nov.	8	6
100,000	1	Perth (W.A.) Electric Tramways Ord.	6d.	7½d.	1 3/32—1 11/32	...	...	25/6	Nov. 8	4 2 0	*Sept.*, Nov.	26/3	⅜
245,000	1	Potteries Electric Traction Ord.	7½	for '11	5/16—7/16	...	...	7/6	Dec. 2	8 0 0	April.	¾	⅝
245,000	1	Do. do. 5% Cum. Pref. ...	6d.	6d.	13/32—15/32	...	...	13/6	Jan. 23	6 19 0	*Feb.*, Aug.	¼	1/16
124,560	1	Provincial Tramways Ord.	8d.	10d.	11/16—13/16	...	...	15/-	Jan. 27	9 4 9	May. *Nov.*	1 1/16	15/-
10,000	10	Do. do. 6% Cum. Pref.	6/-	6/-	9—9½	...	...	9⅝	June 19	6 6 6	June, *Dec.*	11	9
50,000	5	Rangoon Elec. Trys. & Supply Co. 6% Cum. Pref.	3/-	3/-	5⅜—5⅞	...	...	5 13/32	Aug. 31	5 2 3	June, Dec.	6	5
100,000	$100	Sao Paulo Tramway, Light, and Power Co. ...	$5	$5	...	...	...	280	Sept. 30	...	Ja.*Ap.*Jul.Oc.	290	110
32,000	10	Shanghai Elec. Construction Co.	...	...	7¼—8¼	...	...	8	Nov. 28	...	May.	11½	6
330,400£	Stk.	Singapore Elec. Trys. Ltd., 5% Debs. Red. ...	5%	5%	83—86	+ 1	...	84¼	Jan. 23	5 17 9	Mar., Sept.	88	61
169,570	1	S. Metrop'n Elec. Trys. & Ltg. Co. 6% Cum. Pref.	1/2⅞	May, '12	15/16—1 1/16	...	...	15/9	May 16	7 7 9	Feb., Aug.	1⅛	¾
91,720£	Stk.	Southern Elec. Trys. of B.A., 1st Mt. Deb. ...	5%	5%	99—101	+ 4	...	97	Dec. 18	5 1 0	Feb., Aug.	100	90
160,000£	100	Sunderland District Elec. Trys. 5% 1st Mt. Debs.	5%	5%	...	...	...	58⅜	June 1/10	...	Jan., July.	88	58⅛
471,500£	100	Toronto Rly. Co. 1st Mt. 4½% Stg. Bonds ...	4½%	4½%	97—99	...	...	99	Nov. 8	4 11 3	Feb., Aug.	104	97
80,000	5	United Elec. Tramways of Monte Video, Ord....	4/-	3/-	5¼—5¾	...	— ¼	5 7/16	Jan. 23	6 1 9	*June*, Dec.	6½	5
90,000	5	Do. do. do. 6% Cum. Pref.	3/-	3/-	4⅞—5⅜	...	...	5⅛	Jan. 23	5 11 9	June, Dec.	6⅜	4 9/16
500,000£	Stk.	Winnipeg Elec. Rly. Co. 4½% Perp. Cons. Debs.	4½%	4½%	100—103	+ 1	...	101½	Jan. 22	4 8 9	Apr., Oct.	109½	100
40,977	5	Yorkshire (West Riding) Elec. Trys. Ord. ...	...	...	¼—¾	...	...	8/6	Oct. 31	...	*Mar.*	1⅛	⅛
46,261	5	Do. do. do. 6% Cum. Pref.	3/-	1/6	2¾—3¼	...	— ¼	61/3	Jan. 24	6 18 6	*Mar.*	3¾	1¾

ELECTRIC RAILWAY SHARES.

1,854,720£	Stk.	Central London Ord. Stock	3	3	81—83	...	— 1	81½	Jan. 31	3 13 9	*Feb.*, Aug.	89½	60
572,640£	Stk.	Do 4% Pref. Stock	4	4	84—86	+ 1	...	85	Jan. 31	4 15 3	Feb., Aug.	92	80
572,640£	Stk.	Do. Deferred Stock	2%	for '12	81—83	...	— 1	81¾	Jan. 31	2 9 6	Feb., Aug.	91⅜	42
1,480,000£	Stk.	City and South London Cons. Ord. Stock ...	1¼	½	37½—38½	+ 1⅛	...	35¼	Dec. 23	2 8 9	*Feb.*, Aug.	46	26¼
78,000	10	Great Northern and City Pref. Ord. 4% ...	Nil	Nil	2—2¼	...	— ⅛	40/-	Jan. 31	...	*Feb.*, Aug.	2⅞	⅛
50,000	10	Liverpool Overhead Ord.	2/-	2/-	3⅞—4	+ ⅛	...	80/-	Jan. 22	5 3 3	*Feb.*, Aug.	4	⅜
1,412,263£	Stk.	Mersey Cons. Ord. Stock	Nil	5⅜	5¼—5½	...	...	5	Jan. 23	...	*Feb.*, Aug.	8	1
5,732,062£	Stk.	Metropolitan Cons.	1½	1¾	53—55½	...	...	53⅜	Jan. 31	3 2 0	*Feb.*, Aug.	75⅛	34
2,640,914£	Stk.	Do. Surplus Lands Stock	2¾	2¾	61—63	...	...	61 7/16	Jan. 30	4 7 6	*Feb.*, Aug.	72	61 7/16
3,235,000£	Stk.	Metropolitan District Ord.	Nil	Nil	41—41½	+ ½	...	41¼	Jan. 31	...	*Feb.*, Aug.	51½	9½
467,000	10	Underground Electric Railways Co. of London	...	...	4¾—5	+ ⅜	...	97/6	Jan. 30	...	...	5 3/16	1⅜
1,730,000£	...	Do. 4½% Bonds of 1933	4½%	9/8	98—100	...	...	99⅜	Jan. 31	4 10 0	Jan., July	102	73
1,192,707£	...	Do. 6% 1st Income Debs.	...	...	111½—113½	+ ½	...	112⅛	Jan. 31	5 7 9	...	117¼	110½
6,120,750£	...	Do. 6% Income Bonds	20	40	95½—96½	+ 3	...	96⅛	Jan. 31	3 2 3	Mar., Sept.	96¼	18

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dividend at the rate of 6 per cent. per annum for the half-year on the issued share capital (making 5¾ per cent. for the year); £307 to directors, being 10 per cent. of net profits after payment of 5 per cent. dividend for the year; £1,577 to revenue new account. The traffic receipts show an increase of £1,890 and the expenses an increase of £1,947. The directors have transferred £9,500 to reserve for depreciation. Interest has also been credited to the reserve, making a total contribution for the year of £11,448. The County Council will shortly proceed with the construction of tramways from Uddingston to Bellshill, Mossend, and New Stevenston, to connect up with the company's lines. These new lines will be leased to the company. It is the company's intention to shortly inaugurate a service of motor omnibuses.

Edinburgh and District Tramways Company.—The report for the year ended December 31 gives the following results. All the company's lines are worked by cable traction.

	1912.	1911.	Increase or Decrease.	1912. Per Ml. run.	1911. Per Ml. run.
Receipts:	£	£	£	d.	d.
Traffic receipts	295,096	290,369	+ 4,727	10·61	10·49
Other receipts	2,372	2,108	+ 264	0·08	0·08
Total receipts	£297,468	£292,477	+ £4,991	10·69	10·57
Expenditure:					
Working expenses and general charges	151,776	145,813	+ 5,963	5·45	5·27
Corporation charges for rent, etc.	111,759	110,893	+ 866	4·02	4·01
Total expenditure ...	£263,535	£256,706	+ £6,829	9·47	9·28
Profit	£33,933	£35,771	− £1,838	1·22	1·29
Mileage open	25¾	25¾	—	—	—
Miles run	6,676,755	6,640,885	+ 35,870	—	—
Passengers carried (including estimate for season tickets)	64,034,090	62,567,588	+ 1,466,502	—	—

The total receipts thus show an increase of £4,991, and the expenditure of £6,829, resulting in a decrease in profit of £1,838. The ratio of working expenses and general charges to receipts is 51·02, an increase of 1·17. The mileage run has increased by 35,870, and the passengers carried by 1,466,502. The directors recommend the payment of a regular dividend on the preference shares at the rate of 5½ per cent., requiring £2,062, and an additional dividend of 4 per cent., requiring £3,000, carrying forward to the credit of the preferred shareholders £50. The sum at the credit of the deferred shareholders is £7,370, out of which a dividend of 8s. per share is to be paid, leaving £370 to be carried forward.

REPORT OF MUNICIPAL TRAMWAYS ASSOCIATION.

The eleventh annual report of the Association's proceedings for 1911-12 has been issued, and can be obtained from the hon. secretary, Mr. C. J. Spencer, 7, Hall Ings, Bradford, at 2s. 6d. This fine octavo volume of 184 pages contains a full account of the annual conference at West Ham. An excellent portrait of Mr. H. E. Blain, who presided at the meeting, is included, also a group of the members and friends, and the plans, tables, and diagrams illustrating the papers read and discussed on that occasion. The interim report of the Corrugation Committee having been issued separately is not included in the volume, but Mr. McElroy's précis of it and the discussion that ensued are given in full.

INCREASED WHEEL BASE AND SHARP CURVES.

After visiting a number of places to inspect vestibule cars, the chairman of the Hull Tramways Committee and the city engineer have reported as subjoined: "The arrangement of cross seats in the lower saloon of the most recent Liverpool cars provides a greater seating accommodation than can be obtained with side seats, but does not allow the same number of passengers to stand in the cars at crush times; so far as Hull is concerned the additional width required for cross seats prohibits their use. The additional length of wheel base adopted for some of the more recent cars in several towns is an advantage as regards the prevention of pitching of the car, especially when travelling on a defective track, but the quickness of some of the curves in Hull renders it undesirable, in the city engineer's opinion, to increase the length of wheel base, and he has formed this opinion after trying a truck with wheel base temporarily increased to 7 ft. 6 in. on one of our sharp curves. As to enclosed vestibules, we found that those who had used them were not agreed as to their desirability. After carefully considering the matter, we are of opinion that it is not desirable to adopt enclosed vestibules for Hull at the present time, but that we should wait and see what further developments arise on the systems which are trying enclosed vestibules experimentally. As to the type of car to be adopted for additional cars for the Hull system, the only alteration we have to suggest, in the design of the cars last supplied, is the carrying forward of the upper roof over the canopy at each end."

PERSONAL.

Mr. A. G. Balfour has been appointed manager of the Llandudno and Colwyn Bay Tramways.

Mr. H. Lamb has been appointed assistant resident engineer at the Stuart Street electricity works, Manchester.

Mr. F. Riley has been promoted from the post of assistant engineer to that of electrical engineer to Todmorden Council.

Mr. C. N. Hefford has been appointed to discharge temporarily the duties of engineer of Leeds Corporation electricity works.

Mr. John Kerr, who has been a director of the Edinburgh and District Tramways Company since its formation in 1894, has resigned his seat on the board.

Mr. J. Timpson, vice-chairman of Portsmouth Tramways Committee, turned the first sod on January 6 for the new tramway to be constructed in Twyford Avenue.

Mr. William Yorath Lewis has been appointed managing director of the British "Niclausse" Boiler Company, Limited, Caxton House, Westminster, London, S.W.

Mr. C. H. Wright has resigned his position with Crompton and Company, Limited, in order to take up an engagement with the National Steam Car Company, Limited.

Mr. J. W. Dugdale, general manager and engineer, Oldham Corporation Tramways, has been recommended by the Tramways Committee for an increase of salary to £400.

Sir William B. Forwood, in consequence of continued ill-health, has resigned the chairmanship of the Liverpool Overhead Railway, and Mr. H. C. Woodward has been appointed in his place.

Mr. W. H. Cooke. Luton borough electrical engineer, has been recommended by the Electricity and Tramways Committee for an increase of salary from £450 to £600 by annual increments of £50.

Mr. A. Evans, after six months' work as acting traffic superintendent of the Pretoria Corporation Tramways, has been appointed permanently to the post at a salary of £420, rising to £500 a year.

Mr. William Shearer has been appointed as an additional director of Balfour, Beatty, and Company, Limited, London and Edinburgh. Mr. Shearer has acted as secretary of the company since its formation.

Mr. A. Rees, station superintendent, Swansea Corporation Electricity Works, has been appointed chief assistant engineer at a salary of £250 per annum. Mr. A. Ritches, senior charge engineer, has been promoted to fill the vacancy at a salary of £160.

Mr. J. Fairbairn, deputy superintendent at Valley Road power-station, has been recommended by Bradford Electricity Committee for the position of works superintendent, which has become vacant by the resignation of Mr. W. Jones, owing to ill-health.

Mr. T. Rendall has been presented by Alderman Dunsford, chairman of Southampton Tramways Committee, with a writing desk subscribed for by the members of the Shirley section, as a mark of their appreciation of the great interest he had taken in the sports' club.

Mr. J. Dalrymple, general manager, Glasgow tramways, in conjunction with the town clerk and the master of works, has prepared a draft scheme of superannuation for the Corporation officials and employees on the basis of voluntary contributions. It is under consideration by a special committee.

Mr. F. J. Delves, for three years constructional superintendent in the sales department of West Ham electricity undertaking, has been entertained at dinner and presented with a pair of field glasses on leaving to take an appointment as electrical engineer to the United Malaysian Rubber Company, Singapore.

Mr. C. Challenger, manager of the Bristol Tramways and Carriage Company, as commandant of the tramways contingent of the Red Cross Society, presided on January 10 at the distribution of certificates in first aid to the injured and sanitation. Fifty-six certificates were presented, and 39 more men are qualifying. Altogether 150 men have qualified during the past three years.

Mr. C. D. Falcke, late resident engineer to Stratford-on-Avon Electric Supply Company, has opened an office as a consulting electrical and mechanical engineer at 410, Mansion House Chambers, Queen Victoria Street, London. Mr. Falcke, who erected the Stratford works six years ago, is still consulting engineer to the company, and he has also taken up an interesting patent.

Sir John Curtis, ex-Lord Mayor of Cardiff, chairman of the Tramways Committee, was on January 13 presented by the Lord Mayor, on behalf of the City Council, with a pendant and gold badge, the latter a replica of the Lord Mayor's badge, in recognition of his services as chief magistrate. His lordship stated that Sir John did great honour not only to the city, but to his family.

Salaries of Birmingham Officials.—The Electricity and Tramways Committees have recommended that the following increases of salaries be granted: Mr. R. A. Chattock, electrical engineer, from

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£1,200 to £1,500; Mr. H. Foulds, secretary of the electric supply department, from £600 to £750; and Mr. J. McDonnell, tramway traffic superintendent, from £300 to £350 per annum.

Mr. Lee Murray, M.C.E. (Melb.), M.Inst.C.E., M.I.E.E., M.I.Mech.E., has started business on his own account at 10, Norfolk Street, Strand, London, W.C., as engineering representative (buying, inspecting, etc.) for firms and corporations in the colonies and abroad.

Mr. C. H. Built, of the Worcester Tramways Company's staff, has been presented with a marble clock, subscribed for by the members of the employees' recreation club, in recognition of his services as hon. secretary. The presentation was made by Mr. M. Lane, chairman of the committee, at the annual supper, at which Mr. J. R. Groves, the manager, presided. The members cordially honoured the toast of the health of the manager, through whose instrumentality the club was formed.

Mr. H. P. Stokes, the Ilkeston tramways manager and engineer, has received an appointment in a similar capacity under the Bexley Heath Council, Kent. Mr. Stokes went to Ilkeston three and a half years ago from Burton-on-Trent, where he was for seven years assistant to the borough electrical engineer and tramways manager. He was the successful candidate for his new position out of 50 applicants, and he anticipates severing his connection with the Ilkeston Corporation on March 31 next.

Messrs. Robert C. Hour and Cyril W. Davson, the former of Paris, and the latter of London, directors of the Warner International and Overseas Engineering Company, Limited, were passengers by the "Carmania," which left Liverpool on January 4 for New York. Mr. Hour, during his stay, will direct some further applications of the Warner Axle from his headquarters at the office of the company's agent, Mr. Henry F. Vogel, Houser Building, St. Louis. Mr. Davson's headquarters are Hotel Belmont, New York.

Mr. J. Lloyd, general manager, Southport Tramways Company, has been presented with a framed photograph of the whole of the employees, by Mr. Bullin, chief clerk. Representatives of the staff and employees endorsed Mr. Bullin's observations, one of the conductors observing that if they could copy Mr. Lloyd in his tactfulness they would be better men and workers. Mr. Lloyd, to whom the gift came as a surprise, said he trusted that the happy feeling existing among them all might continue.

Mr. W. Clough, manager of the Bury Tramways, read a paper on the tramway system of that town before a meeting of the Local Government Officers' Association. He advocated caution in the granting of concessions in view of the possibilities of developments which may take place in the near future, and he suggested that it might have been wise if Parliament had put a limitation upon the amount contributed out of profits to the rates, in order that the tramway undertakings might be fortified by big reserves when the time should come for adopting any change in the method of transit.

Mr. J. W. McInnes, who has acted as manager of the Llandudno and Colwyn Bay tramways for about two years, has been transferred to the company's London offices. Before leaving, he was presented by the employees with a smoker's cabinet, and Mrs. McInnes received a dressing case. Chief Inspector G. H. Shimmings, in making the presentations, conveyed to Mr. McInnes the thanks of the employees for the part he had taken in initiating the annual supper and for forming the sick benefit club. In returning thanks, Mr. McInnes commended Mr. Balfour, his successor, as a man who would command confidence and respect.

Mr. F. J. S. Hosken, who has been appointed manager of Darwen Corporation Tramways at a salary of £200 a year, will have full charge of the department with the exception of underground cable and track work. Mr. Hosken, who has been the tramway depot superintendent in Darwen for the past 10 years, has had an experience in tramway and electricity works extending over 21 years. A native of Winnipeg, Canada, Mr. Hosken is 36 years of age, and prior to going to Darwen he was depot superintendent at Taunton for the Taunton and Somerset Light Railway for a period of two years, and previously was electrical engineer at New Bond Street (London), Bristol, and St. Austell.

Mr. C. E. C. Shawfield, electrical and consulting tramway engineer to Wolverhampton Corporation, has tendered his resignation consequent on his acceptance of the appointment of joint managing director of the Knowles Oxygen Company. Mr. Shawfield, who came to Wolverhampton from Newcastle, succeeded Mr. Harman Lewis, about 15 years ago, as borough electrical engineer, and was later employed consulting tramway engineer, the salary being £600 per annum. He saw the inception in Wolverhampton of the Lorain tramway system, and it was under his direction that the present routes were laid and equipped. Mr. Shawfield is president of the Municipal Electrical Association and, until the annual meeting in June next, Mr. J. E. Edgcome, of Kingston-on-Thames, will act as president.

Mr. A. T. Lambert, manager of Maidstone Corporation Tramways has been granted an increase in salary as from January 1, 1913. Councillor Lyle mentioned that under Mr. Lambert's management the loss on the undertaking for the year ended March 31 last was reduced by £1,013. The traffic returns during that period were increased by £550, there was a saving in the units consumed equal to £237, the traffic expenses were £202 less, and there was a reduction in the cost of repairs and maintenance of £265. So far this year there was a further increase in revenue of £300, but expenditure had also risen, this being accounted for by the repairs to the permanent way. There was no likelihood of the expenditure in this direction being reduced in the immediate future; nevertheless the increased revenue would cover this extra expense.

Mr. J. Devonshire, the new general manager of the London United Tramways Company, which has been amalgamated with the Metropolitan Electric Tramways Company under the title of the London and Suburban Traction Company, responded to the toast of the directors, submitted by Mr. A. H. Pott, engineer, at the annual dinner of the employees' philanthropic fund, presided over by Mr. Z. E. Knapp. Mr. Devonshire remarked that so far as he had gone he was proud to belong to the London United Tramways. They had lost the managing director, Mr. Stanley, and it would be a comfort to them to know that he remained on the board of directors. They were about to lose their general manager, Mr. Knapp, who came from the Underground, and was about to return thither. But Mr. Knapp had promised them that he would always keep a friendly eye on them. He asked for their cordial co-operation and their loyal help in his difficult task. Mr. W. M. Ackworth, chairman of the directors, also responded.

M. A. G. Broca, managing director of the Compagnie des Tramways de Paris et du Department de la Seine, president of the Tramways and Light Railways Union of France, has been made an officer of the Legion of Honour. **M. L. J. G. Pavie,** assistant manager of the French General Tramways Company, manager of the French Thomson-Houston Company, and vice-president of the Central Company for Electrical Industries, has also been made an officer of the Legion. Our contemporary, *L'Industrie des Tramways*, remarks that M. Broca during his entire business career of 35 years has been actively engaged in the practical working of tramways. He was the designer of the Broca rail which bears his name. For the past 25 years he has directed the Company of Tramways of Paris and of the Department of the Seine, which works lines on the south of the river. M. Broca's colleagues of the French Union of Tramways have entertained him at luncheon to offer their congratulations on the honour which he has received.

London Electric Railway Changes.—The following changes are announced in the boards of the appended companies: Central London Railway: Lord Knollys, Lord Rathmore, and Mr. Robert Fleming have resigned, and Lord George Hamilton, Sir Herbert Jekyll, and Mr. A. H. Stanley have been appointed in their place. Mr. A. H. Stanley will be appointed managing director of the company. Mr. H. F. Parshall has tendered his resignation as a director, to take effect after the half-yearly meeting, when the Hon. Sydney Holland will be elected to fill the vacancy. Lord George Hamilton will become chairman of the board. City and South London Railway: Mr. J. F. S. Gooday, Mr. S. Barclay Howard, and Mr. Edwin Tate have resigned, and Admiral Sir Cyprian Bridge, Mr. T. C. Jenkin (who has resigned as general manager of the company), and Mr. A. H. Stanley have been appointed in their place. Mr. A. H. Stanley has been appointed managing director. London Electric Railway: Lord George Hamilton resigns as chairman, and Lord Farrer will be appointed in his place. Lord Knollys will be elected to a seat on the board.

Mr. Harold Dickinson, manager of the Leeds Corporation electricity department, who has been appointed to a similar position at Liverpool, has been presented with two silver standard lamps and a silver cake basket from over 350 past and present Leeds employees. Alderman Brown, deputy-chairman of the Tramways and Electricity Committee, who presided at the ceremony, expressed his belief that there was not a better electrician than Mr. Dickinson in the country, and Alderman Tetley, chairman of the committee, in handing the gifts to Mr. Dickinson, referred to his 20 years' service in Leeds, and said he had been a progressive and skilful adviser. Mr. Dickinson, in reply, said the old company started with a portable engine driving a 20-KW dynamo, and supplied 20 customers. To-day the capital was nearly a million pounds, and the capacity was 15,400 KW. When they had the new sets, during the year 1913, the capacity would be up to 22,940 KW. He was one who thought the country was on the eve of a tremendous electrical development, when a privately owned power-station would be regarded as a peculiarity, when all the railways would be electrified and when the full uses of electricity would be appreciated for domestic purposes.

P.A.Y.E. CARS AT LEICESTER.

Leicester will have the distinction of first running double-deck cars on the payment on entry system, for while Aberdeen Council have cars in course of construction, two of the new style cars reached Leicester about the middle of January. On January 15 the vehicles were inspected by the Tramways Committee.

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NEW CONTRACTS AND ORDERS.

Mr. J. W. Courtenay has been appointed sole advertising contractor to the Accrington Corporation Tramways.

The Electric Construction Company, Limited, have received an order for a dynamo from the West Bromwich Corporation.

West Ham Council have extended for a further period of one year the contract of the British Westinghouse Company for supplies of transformers.

Sunderland Council have placed contracts with Dick, Kerr and Company for alternator slip rings, and with Babcock and Wilcox for boiler fittings.

The United Electric Car Company, Limited, have received an order from Blackpool Council for six open-type tramcars similar to those previously supplied.

Woods-Gilbert Rail Company, Melbourne, have contracted to deal with corrugations and worn joints throughout the Sydney tramways during the next 12 months.

Messrs. Venner and Company, of Westminster, S.W., have received an order to equip the cars of the Musselburgh and District Tramways with Chamberlain and Hookham meters.

The Hart Accumulator Company, Limited, have been awarded the contract for a storage battery (1,190 ampere-hours capacity) for Yellowgrass electricity works, Saskatchewan, Canada.

Batley Council have accepted the tender of the Tudor Accumulator Company, Limited, for the maintenance, for a period of 12 years, of the battery supplied by that company to the electricity works.

Side Life-guards.—Bradford Corporation have given an order for 100 tramcars to be equipped with side life-guards of the pattern supplied by the National Railway and Tramway Appliances Company.

Bristol Council have placed contracts with the British Westinghouse Company and Bruce Peebles and Company for switch gear and one three-phase to direct-current converter respectively, at £903 and £2,187.

Ferranti, Limited, have received a contract from Bradford Corporation for the supply of switch gear and accessories required for a new 1,500-KW. rotary converter, to be erected at Valley Road works, at £305.

Greenock Council have accepted the tender of the British Westinghouse Company for a Westinghouse-Rateau turbine and alternator of 3,000 KW., with Westinghouse condenser and Leblanc turbine-driven auxiliaries.

The United Electric Car Company are constructing two double-deck cars with top covers and trucks for Ashton Council. Siemens Brothers Dynamo Works will supply complete car equipments and spare parts.

Preston Tramways Committee have recommended the acceptance of the tender of Dick, Kerr and Company, Limited, for rails for relaying a portion of Church Street track, at the rate of £7 17s. 9d. per ton, exclusive of royalties.

British Thomson-Houston Company, Limited, have been awarded a contract by Worcester Council for the supply of a 1,500-KW. steam turbo-alternator, exciter, and Worthington condenser for two-phase supply, at £3,261.

Colchester Council have accepted the tender of H. Lotery and Company to supply the clothing (with the exception of oilskins, southwesters, and caps) for the tramway employees, and of Nunn and Company for the supply of uniform caps.

Clough, Smith and Company, Limited, have secured from Messrs. Trackless Trolley, Limited, the contract for the overhead equipment on the over-running system for the Ingrow to Haworth section of the Keighley Corporation's trackless system.

Stewarts and Lloyds have received a contract from Ramsbottom Urban Council for the supply and erection of standards and fittings required for the railless trolley car service from Holcombe Brook to Edenfield, a distance of three and a quarter miles.

The Motor Rail and Tram Car Company, Limited, of 79, Lombard Street, London, E.C., have received an order from the Baroda Tramway Company, India, to equip their lines with "Simplex" petrol tramcars, which will supersede the horse cars hitherto in use.

Babcock and Wilcox, Limited, have supplied three coal-measuring drums, at £105, to Wolverhampton Electricity Committee, and have been awarded a contract for the supply of two water-tube boilers, superheaters, and chain-grate stokers to Halifax Corporation electricity works.

Walthamstow Council have accepted the tender of Mr. G. P. Trentham for the reconstruction and doubling of track at the Bell junction, doubling a portion of Chingford Road and Forest Road, and the carrying of the track across Ferry Lane Bridge, thus connecting up Tottenham with Walthamstow.

John Taylor, of 7, Strand Street, Liverpool, has received orders from Sheffield Corporation Tramways for 24 patent sanding devices, and from Bolton Corporation for 50 sanders, also for 32 sets from the United Electric Car Company, Limited, Preston, for new cars ordered by the Bolton and Ashton Corporations.

The British "Niclausse" Boiler Company, Limited, have recently installed a large boiler at Messrs. Siemens Brothers' works at Stafford. The "Niclausse" Company are arranging to manufacture boilers and mechanical stokers in this country in accordance with the standards of Messrs. J. and A. Niclausse, of Paris.

Cars and Indicators for Bury.—The Council have empowered the Tramways Committee to obtain four small cars, and to purchase 40 coloured glass indicators suitable for attaching inside the cars, so as to afford additional means of indicating the destination of a car. The colours will be varied so as to distinguish the routes.

York Council have placed the work of constructing the overhead electrical equipment of the new Bishopthorpe Road extension in the hands of the city electrical engineer, who reported that he could carry out the task at a saving of over £353 upon the amount of the lowest tender received, in strict accordance with the same specification.

London County Council have purchased from George Schultz and Company 51 pony wheel steel tyres for electric cars at 10s. 8½d. a tyre, and from Brown Bayley's Steel Works 50 tyres at 21s. 6d. each. The Council have also purchased from Doulton and Company 500 earthenware plough bases and 1,000 lead covers therefor, at 8s. 6d. per base and 6d per cover, less 2½ per cent. discount.

Willans and Robinson, Limited, were the successful tenderers for the supply, delivery, and erection of a 2,000-KW. turbo-alternator, with exciter and surface condenser, to Keighley Council, at £5,827. Dick, Kerr and Company, Limited, will make the alternator. Willans and Robinson, Limited, have also obtained a contract for the supply of a 5,000-KW. turbo-alternator to Dundee Corporation.

The United Electric Car Company, of Preston, have received a contract for the supply of four car bodies to Bury Tramways Committee. The committee had inspected several types of vestibules and weather shields, and decided that they could not recommend any of them for fitting to the new cars. The committee are going to Bolton to inspect a weather shield to be put into use there.

The J. G. Brill Company, of 110, Cannon Street, London, E.C., are constructing four of their latest swing-bolster centre-bearing bogie trucks, No. 39-E-1, for the Gateshead and District Tramways Company. These bogie trucks have solid forged sidebars, and the unusual method of operating with the pony wheel towards the platforms. This particular bogie truck is getting widely known for its very easy riding qualities.

Messrs. Thermit, Limited, London, have contracts in hand, or shortly to be started, for the welding of the tramway rails on the following, among other systems: Ayr, Bolton, Birmingham, Dublin, London County Council, Manchester, Portsmouth, Salford, York, etc. The number of joints welded on new and reconstruction work during 1912 amounted to over 15,000, which is equivalent to nearly 90 miles of single track, 60 ft. rails

Halifax Tramways and Electricity Committee have awarded the following contracts: Babcock and Wilcox, Limited, two water-tube boilers and superheaters, £3,900, and chain grate stokers, £840; British Thomson-Houston Company, Limited, extra-high-tension feeder cell at electricity works, £82; Drakes, Limited, fixing of steel mains and cast-iron bends, £69; Babcock and Wilcox, Limited, high-pressure steam piping and exhaust piping, £103.

Hudson and Bowring, Limited, have received the following orders for "HB" lifeguards: Through their Continental agent, 40 sets for La Croyere, 38 for Valenciennes, 10 for Toulon; through the United Electric Car Company, two sets for Ashton, and two for Darlington; 36 for the United Electric Car Company, five for the Brush Company; and through the Brush Company, two for Barrow, six for Halifax, and 10 for Johannesburg.

London County Council have accepted the following tenders: Thomas Bolton and Son, 3½ miles of grooved trolley wire, £109 4s. per mile; Cammell, Laird, and Company, 3,000 pairs of tramway rail fish plates, at £9 15s. a ton, total, £780; C. and A. Knifton (trading as H. Crane), removal of sludge from tramway conduits north of the Thames during the year ended January 21, 1914, 1s. 9d. per cubic yard; Samuel West, Limited, removal of sludge from tramway conduits south of the Thames during the same year, 3s. 1d. per cubic yard (total cost for both north and south about £5,600); Elliott Brothers, 17 instruments for testing magnetic brake coils, £10 11s. 6d. each.

Glasgow Corporation have placed contracts as appended: Special trackwork, Titan Trackwork Company, Limited; rawhide pinions, Reid Gear Company; traction lamps, Siemens Brothers Dynamo Works, Limited, General Electric Company, Limited; double cotton-covered wire, London Electric Wire Company, Limited; copper and bronze strip, P. and W. MacLellan, Limited, stopping-place sign-posts and brackets, J. and A. Law, Limited, Walter Macfarlane and

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Company; route number plates, P. and W. MacLellan, Limited; arc lamp carbons, General Electric Company, Limited; old rails, P. and W. MacLellan, Limited; trolley cord, W. C. Yuille and Company, Limited. The Council have extended their contract with the British Westinghouse Electric and Manufacturing Company for the supply of rotary converters, so as to include two additional rotary converters, with the necessary high and low-tension switch gear.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

ANNUAL DINNER.

The annual dinner and smoking concert of this Association will be held at the Empire Rooms, Trocadero Restaurant, Piccadilly Circus, W., on Thursday, February 27, 1913, at 7-30. Small tables to seat eight will be provided, and members wishing to reserve single seats, or to make up parties, are requested to notify the Secretary, Caxton House, S.W., at an early date.

EVOLUTION OF THE WASTE TICKET BOX AT GLASGOW.

With a total of nearly 7,000,000 tickets issued in the first week of the New Year, little imagination is required to picture the condition of the cars and streets if passengers had not been trained to place used tickets in the boxes provided for that purpose. At first only one box was placed on the panel at each end of car, and soon it was discovered that these were too small to hold all disused tickets. Another box was affixed to the dashboard for the convenience of persons who travelled on the top. Experience showed that the box on the panel was most used, and consequently long before night they were filled to overflowing. Therefore in the later cars larger and more commodious boxes, specially designed, have been attached. When the car reaches the depot at night, the boxes are emptied and the tickets are put into sacks and sold as waste paper to merchants. The yield is from a ton and a quarter to a ton and a half per week, and the proceeds suffice to defray the cost of fixing the ticket-deposit boxes to the cars.

East London Railway Electrification.—The report of the East London Railway for the last half-year states that the electrification of the line is making good progress, but the opening for electrical working will probably not be possible until early in April.

TRAMWAY AND LIGHT RAILWAY NOTES.

BELFAST.—The Board of Trade inspection of the Belfast tramway extensions was conducted on January 28 by Major Pringle, and the lines were opened for traffic on the following day.

BRADFORD.—The clause under which the Tramways Committee proposed to apply for powers to enable the department to manufacture tramcars and trolley vehicles, has been deleted from the bill to be promoted by the Corporation.

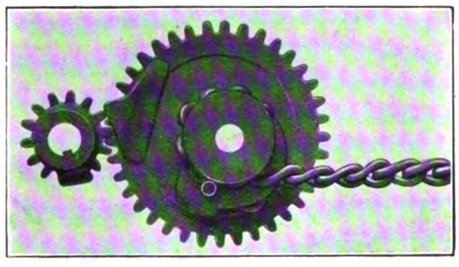
BRIGHTON.—About a quarter of a mile of the tramways between the Pavilion and the Aquarium has been relaid with heavier rails and manganese steel points and crossings. The rails are welded by the Thermit process. An automatic watering device has been fitted to the curves to facilitate quiet working.

BURNLEY.—Subject to the consent of the Board of Trade, the Burnley Council have authorised a further trial for 12 months on extended routes of the heavy parcels (56 lb. to 3 cwt.) service between Nelson and Padiham on the main line. The arrangements for the service and an illustration of the goods car were given in our issue of December 12. Alderman Heap, chairman of the committee, stated that besides the heavy parcels traffic, they had in view the running of the wagon for the use of the department in carrying material to and from the depot.

BIRMINGHAM.—Colonel Druitt, of the Board of Trade, on January 10 inspected the new lines in Villa Road, Hampstead Road, and Grove Lane, Handsworth, and confirmed the provisional authority given for the tramways to be worked. The new lines form a loop with the Wheeler Street lines at Lozells. Street improvements in Colmore Row having been completed, work has been begun in connection with the electrification of the cable tramways between Colmore Row and Snow Hill. The new lines will be brought close to the footpath by the side of St. Philip's Church, so that passengers will be able to board the cars from the footpath.

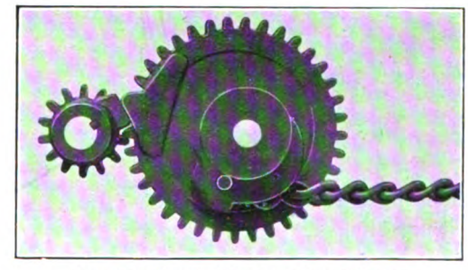
DUDLEY.—The Tramways Company having applied to the Board of Trade for a revision of the regulations, the General Purposes Committee of the Town Council have decided to oppose the suggestion that certain statutory stops be abolished. They recommend that sanction be given to an increased maximum speed from eight to ten miles on the Stourbridge line, and from six to eight on the Netherton line, but advise that the maximum for Castle Street, High Street, and Upper High Street be not increased.

THREE SEPARATE ORDERS FOR



Winding—Note the Stops.

512
400
300



Unwinding—Note the Stops.

"PEACOCK" IMPROVED BRAKES

A TEST ON WHICH YOU SHOULD INSIST.

In some recent trials of geared hand brakes the engineers found that the motormen were in the habit of guessing as to when the brakes were released, and of letting them only partly off, with the result that current was uselessly consumed and brake blocks and tyres were unnecessarily worn. They, therefore, insisted that in each trial the motormen should release the brakes completely before re-applying them, and under these conditions found that on the average the "Peacock" IMPROVED Brake, by reason of the stops which prevent overrunning of the drum, saved THREE-QUARTERS of a turn of the handle.

THE "PEACOCK" BRAKE CO., 27, Clements Lane, LONDON, E.C.

— AND REPRESENTATIVES IN —

Glasgow, Dublin, Sheffield, Paris, Hamburg, Brussels, Genoa, Barcelona, Winterthur, Sydney, Melbourne, Wellington, N.Z., Buenos Ayres, and Osaka.

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GLASGOW.—In connection with the scheme to erect a new power-station on the outskirts of Birmingham, 13 members of the City Council visited Glasgow on January 7, and inspected several of the Corporation's power-houses. Bailie Kirkland informed the visitors that the tramways department were generating and distributing electrical energy almost as cheaply, if not more cheaply, than any other electricity department in the country, and that was a point which would have to be considered in any proposal for the unification of that department with that administered by the Electricity Committee.—At a meeting of the City Council, Bailie Kirkland, replying to a question as to the number of motormen and conductors who had left the service, and how many had been dismissed between September, 1911, and August, 1912, and the reasons for the dismissals, said the number who had left was 364, and the dismissals, 73. The committee had decided that he should not attempt to give an answer to the request for reasons for dismissal. Cries of "Hear, hear," greeted the latter statement.

LIVERPOOL.—The new single-truck double-deck cars, with two staircases at each end providing separate exits and entrances to and from both decks (which were illustrated and described in our issue of November 14, 1912), were put in service on January 7, on the Aintree-Aigburth route.

MANCHESTER.—A three months' trial is being given on three routes to an increase of penny stage distances to those formerly given for threehalfpence, the distance for the latter being extended to what were previously twopenny stages. If the financial result proves favourable the reduced fares will be granted on six other routes. The suggestion of halfpenny fares for the near districts does not meet with the committee's acceptance. Its tendency, they consider, would be to fill the cars at the start with halfpenny passengers to the exclusion of persons desirous of travelling longer distances.—Mr. J. M. M'Elroy, manager of the tramways, was a witness on behalf of the Corporation at a Local Government Board inquiry held in January into applications made by the Corporations of Manchester and Salford with regard to the extension of their boundaries, so as to include the Urban District of Heaton Norris. The Urban Council supported the Manchester application. Mr. M'Elroy stated that the Tramways Committee had adopted the policy of giving a long distance for a penny fare, in order to get the people away from congested areas, instead of adopting short halfpenny stages. It would be a serious thing for the committee to be constantly decreasing fares and increasing distances if that simply resulted in their carrying Manchester citizens outside the city. The committee adopted the three-fold policy—better travelling facilities, better conditions of service for the employee, and some profit for the relief of the rates. When the lease of the Heaton Norris portion of the tramway expired, there would probably be a one-minute service to Heaton Moor Road, and he could not imagine who but Manchester could work that. It was as important for Stockport as it was for Manchester that there should be through communication between the two towns, and Stockport had granted to Manchester a lease of its part of the line connecting them.

OLDHAM.—On the recommendation of the tramways manager application is to be made to the Board of Trade for authority to increase the speeds on certain routes.

SHEFFIELD.—The Corporation on January 8 adopted a report from the Tramways Committee and Electric Light Joint Committee stating that it is advisable to at once take steps to connect the two electric power and light stations, and install converting plant at Kelham Island, by which means both stations will in future be available for the supply of energy to the tramways. The capital expenditure will be, on the tramways department £8,500, electric supply department £1,100.

SOUTHPORT.—By 27 votes to 21 the Corporation on January 14 decided to follow the advice of Mr. C. W. Mallins, Liverpool tramways manager, and abolish all contract and preferential fares, except current contracts and the statutory cheap fares to the working classes. The original price of the contracts was £2 10s. a year, and it was reduced a year ago to £2. The revenue was £601 a year. The chairman of the Tramways Committee asserted that some persons secured 48 rides a day for the sum of 9d. per week. A speaker also alleged that some holders transferred their tickets to friends. Councillor Winterbottom mentioned that 93 towns had been consulted, and in 85 of those places contract tickets had been abolished.

The Kearney High-Speed Railway.—A demonstration of this invention was given on January 7 with a working model at Olympia, London. Mr. Chalmers Kearney announced that as a result of experiment he had been able to overcome the gyrostatic effect of the motors and wheel upon the guiding rail, and the danger of high speed had been done away with. It would be possible to attain a speed of 150 miles an hour. During the demonstration the cars were brought to a standstill and restarted on a gradient of 1 in 7. A full-size passenger car is being built by the Brush Company at Loughborough, and will be exhibited on an actual railway in the Ghent Exhibition this year.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given below in italics.**

APPLICATIONS.

Applications for Letters Patent have been filed:

29,724 Car couplers—J. T. McCracken and B. W. McCracken.
29,767 Air brake mechanism—E. S. Farrell and C. Macintosh and Company, Limited.
29,828 Railway track construction—O. Imray (*J. W. Stephenson*).
29,842 Electric switches—British Thomson-Houston Company, Limited (*General Electric Company*).
29,872 Anti-creeping devices for track rails—O. Imray (*J. W. Stephenson*).
29,873 Rail track anchors—O. Imray (*J. W. Stephenson*).
29,905 Automatic instantaneous switches for alternating and direct-current circuits—A. M. Taylor.
29,937 Life-guard for motor omnibuses, trams, etc.—W. J. Nelson.
29,999 Method of and apparatus for electric welding—R. Haddan (*Cleveland Welding and Manufacturing Company*).
30,105 Electric regulating devices—British Thomson-Houston Company, Limited (*General Electric Company*).
30,106 Systems of electric distribution—British Thomson-Houston Company, Limited (*General Electric Company*).
30,107 Regulation of dynamo-electric machines—British Thomson-Houston Company, Limited (*General Electric Company*).

1913.

4 Combined reciprocating engine and turbine power installations—J. Turnbull.
142 Railway switches—E. H. Steedman.
166 Device for lubricating tramway rails—K. Prosch, Kaufmann and Company, and C. Straus.
216 Omnibuses—London General Omnibus Company, Limited, G. J. Rackham, J. O'Neill, L. Messervy, and W. J. Iden.
218 Alumino-thermic and similar methods of uniting rails—Th. Goldschmidt Akt.-Ges.
259 Devices for moving railway and tramway points—L. A. Parrock.
292 Lubricators for bearings—J. Kerber.
347 Automatic life-saving device for motor omnibuses, trams, etc.—E. Whitaker.
356 Electric welding—L. M. Waterhouse.
389 Combined non-skid, non-splash, and life-guard for motor road vehicles—J. L. B. Jackson.
413 Chairs for railway rails—S. Dumartin.
486 Traffic controlling apparatus—J. S. Holliday.
506 Street indicators for tramway vehicles, etc.—R. Travers.
520 Guide attachment to trolley poles—J. Hill.
594 Wheel guards or fenders for motor vehicles—F. S. Turner.
664 Electrical signal system in connection with tramway single lines with loops, or any electric traction either along the public thoroughfare, in mines, or on permanent railways—E. Lawson.
672 Connection of motors of electric tramcars or other rail carriages to prevent side swing—I. Bulfin.
685 Life-guard for affixing to vehicles—W. J. Alldred.
777 Means for automatically stopping trains—W. Thomas.
989 Life-guard or guard to be fixed to motor 'buses—J. I. Lonnon.
1,003 Wheels for motor omnibuses—J. J. Statham.
1,122 Automatic brake for mechanically-propelled vehicles—W. Say.
1,128 Tramcar signals and barriers—C. W. Mallins.
1,179 Apparatus for uniting rails—Th. Goldschmidt Akt.-Ges.
1,231 Railway or tramway signal—A. H. Johnson.
1,455 Outdoor seats for tramcars, omnibuses, etc.—F. Garnett.
1,484 Lubricating devices for rail wheel axles—J. O. Ladds and J. J. Perkins.
1,505 Electrically-operated steering gear—British Thomson Houston Company, Limited (*General Electric Company*).
1,591 Electric motor-control systems—Siemens Brothers' Dynamo Works, Limited, F. Lydall, and A. M. Duke.
1,592 Electrical distant control systems—Siemens Brothers' Dynamo Works, Limited, F. Lydall, and A. M. Duke.
1,666 Accident and mud-guard for motor omnibuses—A. E. Boyce.
1,750 Anti-splash attachment for wheels of motor omnibuses—J. W. McLaren.
1,964 Train speed limit device—J. N. C. Kennedy.
1,979 Springs for railway and road vehicles—R. Blakoe.
2,062 Guard to be fixed to the front of a motor omnibus—S. W. C. Coen.

SPECIFICATIONS PUBLISHED.

1911.

21,793 Means for supporting rails and for securing them to metal sleepers—Truka.
27,162 Safety apparatus for ensuring the safety of trains at stations—Anczykowski.

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DIRECTORY OF ELECTRIC TRAMWAYS.

A complete Directory of Electric Tramways in the United Kingdom will be found among the advertisement pages preceding the reading pages of this issue.

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SHEFFIELD.

27,457 Indicating on motor cars, trains, etc., their position on the route—Jones.
28,319 Buffers for railway and tramway vehicles—George Turton, Platts and Company.
28,031 Means for deadening the noise caused by the passage of trains, tramcars, etc., through tubes—Evans.
28,597 Brake chains—Spary.

1912.

63 Sockets for screw spikes for fixing rails on sleepers—Wagner.
164 Mud-guards for motor 'buses—Richardson.
9,913 Railway sleepers constructed of reinforced concrete—Chipley.
14,754 Railway track rails—Heckmann.
23,841 Fenders for vehicles—Wegner, Sleepack, and Wegner.
1,331 Chain brakes—Cater.
6,286 Insulators—Bullers, Limited, and Twiss.
10,973 Compressed air and vacuum brake mechanism particularly for high-speed railway trains—Vielmetter.
18,959 System of reinforced concrete slabs for improving and consolidating railway tracks—Liebeaux.
3,532 Electric distribution systems—British Thomson-Houston Company, Limited, Taylor, Whitaker, and Sporborg.
4,529 Dynamo-electric generators—British Thomson-Houston Company, and Garton.
4,640 Steam superheating tubes for locomotives—Howell.
4,981 Point levers for use on railways—Vellere.
5,701 Railway sleepers and means for securing rails thereto—Arellano.
6,717 Insulating fish-plate for railway or tramway rails—Cooke and Johnson.
7,497 Turbine dynamo plant—Warwick Machinery Company *(General Electric Company)*.
9,844 Axle boxes and bearings for railway vehicles—Parkes.
10,208 Automatic block signalling systems—White *(Carson)*.
13,794 Air brakes—Christensen.
14,861 Railway car couplings—Sole, Farley, and Mackle.
5,469 Trolley collectors for electrically driven tramcars or road motor vehicles—Estler.
5,636 Device for attaching overhead line wires to insulators—Paton.
18,440 Electro-magnetic brakes—Albert Thode and Company.
21,858 Means for securing rails, chairs, or chair plates to railway sleepers—Cook.
606 Metal sleepers and means for securing rails thereto—Seymour.
610 Railway rail joints—Kaylor.
2,193 Rail joints—Heywood and Thorpe.
3,231 Locomotives—British Thomson-Houston Company *(General Electric Company)*.
26,295 Electro-magnetic track brakes—Magnet Bremsen Ges.

TRAFFIC RETURNS.

TRAMWAYS AND OMNIBUSES.	1912. WEEKS ENDING.					1913. WEEKS ENDING.					AGGREGATE.		
	Jan. 5.	Jan. 12.	Jan. 19.	Jan. 26.		Jan. 4.	Jan. 11.	Jan. 18.	Jan. 25.		Wks.	1913.	Increase or Decrease.
	£	£	£	£		£	£	£	£			£	£
Aberdeen Corporation	1,827	1,453	1,313	1,412	...	1,749	1,644	1,489	1,411	...	34	52,409	+ 898
Ayr Corporation	253	184	179	175	...	271	196	183	188	...	36	12,139	+ 338
Bath Electric	755	700	672	618	...	855	719	664	662	...	4	2,900	+ 155
Birmingham Corporation	10,725	9,887	9,256	9,370	...	11,521	10,940	11,324	11,350	...	43	467,412	+130,859
Blackburn Corporation	1,261	1,036	988	941	...	1,366	1,043	965	1,118	...	43½	51,615	+ 1,347
Blackpool and Fleetwood	350	250	188	244	...	390	232	216	231	...	4	901	− 73
Blackpool Corporation	632	434	407	364	...	751	466	426	446	...	43	66,259	+ 6,077
Bolton Corporation	2,910	2,333	2,214	2,289	...	3,185	2,315	2,430	2,516	...	43	111,416	+ 1,093
Bournemouth Corporation ...	1,558	1,482	1,434	1,326	...	1,634	1,491	1,506	1,492	...	43½	80,882	+ 2,483
Bradford Corporation	5,167	4,786	4,802	5,289	...	5,508	4,917	5,104	5,379	...	43	239,000	+ 2,486
Brighton Corporation	838	814	765	755	...	863	792	773	769	...	43	44,290	− 938
Bristol	6,570	6,215	6,114	5,606	...	7,921	7,033	6,870	6,715	...	4	23,826	+ 1,240
British Elec. Trac. Co's. Undertakings													
Airdrie	424	253	260	267	...	439	291	258	295	...	4	1,071	+ 177
Barnsley	193	173	187	184	...	227	188	188	206	...	4	668	+ 59
Barrow	308	286	297	297	...	366	310	296	337	...	4	1,083	+ 80
Birmingham and Mid. Joint Com.:													
Birmingham and Midland ...	917	874	861	818	...	1,009	937	934	971	...	4	3,218	+ 307
Dudley-Stourbridge	812	746	687	696	...	894	823	792	806	...	4	2,739	+ 314
South Staffordshire	876	848	832	780	...	1,119	993	975	1,041	...	4	3,388	+ 560
Wolverhampton District ...	472	442	370	419	...	545	478	464	495	...	4	1,619	+ 184
Devonport	541	517	492	476	...	564	530	537	519	...	4	1,838	+ 127
Gateshead	1,182	994	991	995	...	1,257	1,027	954	1,059	...	4	3,550	+ 148
Gravesend and Northfleet ...	214	209	196	195	...	229	212	209	207	...	4	712	+ 31
Greenock-Port Glasgow	775	584	664	643	...	840	671	610	730	...	4	2,399	+ 219
Jarrow	132	114	112	110	...	145	120	104	122	...	4	392	+ 17
Kidderminster	100	88	84	88	...	110	88	85	92	...	4	299	+ 7
Merthyr...	209	191	189	190	...	221	196	197	206	...	4	677	+ 30
Metropolitan Electric	8,830	8,216	8,155	8,082	...	8,902	8,724	8,431	8,213	...	4	28,928	+ 919
Middleton	321	265	263	256	...	320	279	273	284	...	4	974	+ 82
Oldham-Ashton	591	541	562	507	...	607	547	538	546	...	4	1,879	+ 62
Peterborough	121	115	111	108	...	128	120	120	121	...	4	404	+ 27
Potteries	2,048	1,976	1,857	1,931	...	2,094	2,004	2,050	2,118	...	4	6,959	+ 527
Rothesay	106	46	40	40	...	100	56	47	40	...	4	206	+ 40
Sheerness	51	45	45	43	...	51	47	48	46	...	4	163	+ 8
South Metropolitan	798	717	697	662	...	854	760	721	684	...	4	2,494	+ 130
Southport	261	225	208	225	...	274	248	217	226	...	4	816	+ 103
Swansea...	1,150	1,102	1,047	1,061	...	1,254	1,157	1,130	1,120	...	4	3,930	+ 247
Taunton	43	43	40	39	...	52	46	46	45	...	4	157	+ 17
Tynemouth	169	131	129	123	...	192	146	130	149	...	4	513	+ 81
Weston-super-Mare	25	31	26	21	...	35	27	31	28	...	4	100	+ 11
Worcester	261	256	232	227	...	288	264	241	248	...	4	862	+ 39
Wrexham and District	112	89	89	88	...	120	101	99	103	...	4	344	+ 46
Yorks. (Woollen) District ...	1,204	1,023	1,041	967	...	1,324	1,160	986	1,196	...	4	3,969	+ 546

(Continued on page 118.)

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TRAFFIC RETURNS—*continued.*

TRAMWAYS AND OMNIBUSES.	1912. WEEKS ENDING. Jan. 5.	Jan 12.	Jan. 19.	Jan. 26.	1913. WEEKS ENDING. Jan. 4.	Jan. 11.	Jan. 18.	Jan. 25.	AGGREGATE. Wks.	1913.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Burnley Corporation	1.508	1.352	1.264	1.200	1.639	1.356	1.503	1.572	43	65.420	+ 5.428
Burton-on-Trent Corporation	284	271	267	252	292	273	258	272	43	11.793	- 443
Bury Corporation	1.282	1.145	1.080	1.114	1.370	1.163	1.223	1.225	43	55.867	+ 378
Cardiff Corporation	2.395	2.366	2.282	2.194	2.575	2.476	2.435	2.485	43	106.057	- 74
Chatham and District	848	792	780	760	951	860	851	843	3	2.808	- 1
Chesterfield Corporation	243	206	212	206	259	219	211	237	43	9.818	- 2
Colne and Trawden	219	209	190	200	231	192	216	237	4	876	+ 58
Cork Electric	476	461	453	419	457	465	431	413	3	1.442	- 153
Croydon Corporation	1.755	1.618	1.581	...	1.683	1.536	1.506	...	42	75.236	- 790
Darlington Corporation	228	208	211	214	249	218	217	221	43	9.752	+ 189
Derby Corporation	902	889	822	788	934	820	888	875	43	38.397	- 1.082
Dover Corporation	209	201	188	182	218	198	193	193	43	10.497	- 569
Dublin and Lucan	77	107	109	109	51	115	107	106	4	379	- 24
Dublin United	5.896	5.470	5.445	5.137	5.894	5.734	5.515	5.352	4	19.127	+ 400
Dundee City	1.479	1.141	1.097	1.070	1.419	1.387	1.122	1.167	36	44.117	+ 1.399
East Ham Corporation	1.101	1.069	1.046	1.008	1.164	1.121	1.129	1.115	43	46.712	- 584
Exeter Corporation	310	288	278	260	328	298	284	276	43	14.077	- 728
Glasgow Corporation	20.912	17.110	17.454	17.151	23.078	18.777	18.007	18.802	34	647.958	- 811
Glossop (Urban Elec. Supply Co.)	120	119	111	113	126	106	121	125	4	479	+ 15
Halifax Corporation	1.937	1.556	1.604	1.557	2.158	1.907	1.621	1.749	42½	86.149	+ 1.910
Hastings and District	857	756	686	708	906	764	702	700	4	3.072	+ 65
Huddersfield Corporation	1.891	1.809	1.724	1.787	2.086	1.889	1.920	2.017	45	86.774	+ 2.838
Hull Corporation	3.098	2.983	3.041	2.956	3.204	3.022	3.017	3.088	43	129.041	+ 1.878
Ilford U.D. Council	507	481	477	471	443	413	422	411	43	20.427	- 2.702
Ilkeston Corporation	124	126	119	112	106	101	114	114	44	4.967	- 826
Ipswich Corporation	379	346	343	328	400	365	361	358	42	19.118	+ 9
Isle of Thanet	274	280	246	247	315	267	273	264	17	5.392	- 52
Kilmarnock Corporation	224	148	139	147	240	151	144	151	36	6.001	- 122
Lanarkshire	2.253	1.327	1.362	1.374	2.268	1.676	1.350	1.477	3	5.512	+ 9
Lancashire United	1.531	1.131	1.204	1.134	1.591	1.299	1.126	1.267	3	4.079	+ 149
Leeds City	7.351	7.124	6.877	7.171	7.848	7.151	7.137	7.541	43	335.684	+ 11.930
Leicester Corporation	2.504	2.494	2.568	2.467	2.725	2.487	2.661	2.674	4	9.510	+ 557
Leith Corporation	752	595	572	555	798	657	612	608	36½	24.747	+ 841
Liverpool Corporation	12.520	11.857	11.103	11.147	12.689	12.050	12.049	12.144	3½	44.118	+ 2.397
Llandudno and Colwyn Bay	177	134	121	114	185	140	140	133	8	1.175	+ 58
London County Council	44.175	43.437	40.825	42.005	41.996	42.242	42.983	40.901	43	1.788.377	- 87.278
London General Omnibus	39.783	38.438	36.313	36.356	58.065	55.354	52.657	52.657	4	218.734	+ 67.833
London United	5.665	5.525	5.339	5.154	5.971	5.435	5.352	5.222	4	21.978	+ 295
Lowestoft Corporation	155	151	139	133	169	147	149	169	16	2.882	+ 40
Maidstone Corporation	174	155	153	148	196	163	165	162	43	8.279	+ 365
Manchester Corporation	16.524	15.963	15.285	15.356	17.412	16.293	16.110	16.683	43	724.354	+ 27.618
National Steam Car	...	...	...	...	...	...	...	...	—	—	—
Nelson Corporation	160	152	155	144	199	157	183	183	43½	8.490	+ 593
Newcastle-on-Tyne Corporation	4.346	4.046	4.089	4.080	4.878	4.260	4.229	4.523	43	192.132	+ 6.168
Newport (Mon.) Corporation	703	679	648	631	770	707	696	729	43	30.729	+ 95
New St. Helens and District	735	780	606	548	862	654	604	653	30	22.380	+ 453
Northampton Corporation	515	483	511	487	572	560	503	519	43	23.244	+ 61
Nottingham Corporation	3.044	2.987	3.093	2.934	3.260	3.087	2.917	3.115	43	136.304	+ 1.987
Oldham Corporation	1.889	1.843	1.754	1.766	2.008	1.928	1.971	1.998	44	90.290	+ 5.516
Portsmouth Corporation	1.916	1.817	1.717	1.598	2.029	1.873	1.841	1.691	43	91.449	- 4.315
Preston Corporation	761	741	759	668	854	794	698	776	43	35.657	+ 1.752
Provincial	1.653	1.605	1.535	1.480	1.701	1.636	1.618	1.571	17	27.404	+ 1.229
Reading Corporation	629	637	609	582	727	625	626	650	42½	27.773	- 141
Rochdale Corporation	1.408	1.308	1.173	1.230	1.544	1.326	1.355	1.438	43	66.041	+ 5.519
Rotherham Corporation	789	658	663	652	1.175	833	740	835	42½	33.807	+ 4.318
Salford Corporation	4.750	4.695	4.429	4.474	5.270	4.626	4.754	4.821	43	215.752	+ 4.382
Sheffield Corporation	6.813	6.459	6.353	6.566	7.479	6.734	6.938	7.069	44	299.178	+ 14.450
Southampton Corporation	1.225	1.193	1.158	1.108	1.198	1.190	1.200	1.179	42	53.090	- 117
Southend-on-Sea Corporation	498	467	456	430	657	577	525	549	43	33.833	+ 3.851
South Shields Corporation	641	550	563	543	723	600	631	614	43	27.586	+ 621
Sunderland Corporation	1.394	1.190	1.172	1.170	1.466	1.196	1.247	1.273	43	56.534	- 851
Swindon Corporation	166	152	125	139	182	148	142	143	42½	6.688	- 295
Tyneside Tramways and Tramroad	271	398	412	411	430	420	355	412	4	1.272	- 160
Wallasey Corporation	1.110	1.017	933	948	1.074	1.012	984	987	43	47.670	- 171
Walsall Corporation	560	547	489	540	597	584	584	606	4	2.121	+ 39
Walthamstow U.D. Council	673	648	632	616	698	652	634	635	43	31.103	- 1.083
Warrington Corporation	469	421	405	405	469	430	428	435	43	18.606	+ 1.210
West Ham Corporation	2.730	2.650	2.666	2.597	2.746	2.687	2.616	2.630	42½	112.584	- 3.961
Wigan Corporation	1.422	1.221	1.225	1.199	1.534	1.292	1.200	1.362	42½	57.592	+ 2.323
Wolverhampton Corporation	933	903	760	881	1.004	962	1.008	986	44	45.068	+ 1.924
Yorkshire (West Riding)	1.194	1.280	1.125	1.178	1.448	1.080	1.184	1.316	4	5.028	+ 250
FOREIGN TRAMWAYS.											
Anglo-Argentine	51.425	50.793	48.326	49.930	57.155	55.588	53.253	53.174	4	219.170	+ 18.696
Auckland (28 days)	...	...	...	...	...	...	...	...	—	—	—
Bombay	3.053	...	...	...	3.172	...	...	...	1	3.172	+ 119
Brazilian Street (month) Mlrs.	47.221	...	...	...	47.512	...	...	...	21	218.854	- 1.238
Brazilian Traction	...	...	...	...	85.114	85.385	85.521	84.639	4	340.659	—
Brisbane (month)	24.230	...	...	...	25.890	...	...	...	52	254.311	+ 2.211
British Columbia (month) $	523.003	...	...	...	613.654	...	...	...	26	3.436.466	+635.072
Buenos Aires Port and City (month)	6.498	...	...	...	6.216	...	...	...	52	74.065	+ 5.824
Buenos Ayres Lacroze (month)	43.600	...	...	...	47.295	...	...	...	26	264.126	+ 32.782
Calcutta Rs.	92.699	70.030	61.942	56.894	70.718	72.362	66.778	64.288	4	2.74.146	- 7.419
Cape Town (month)	13.019	...	...	...	14.147	...	...	...	26	68.640	+ 4.213
Carthagena and Herrerias (month)	...	...	...	1.532	...	...	...	3.324	4	3.324	+ 1.792
East India (month)	1.613	...	...	...	1.842	...	...	...	21	9.530	+ 2.209
Kalgoorlie (month)	3.389	..	...	...	3.206	...	...	...	52	37.810	- 3.523
La Plata (month)	4.557	...	...	...	5.862	...	...	...	52	52.176	+ 3.228
Lima (month)	31.927	...	...	...	34.010	...	...	..	52	373.101	- 340
Madras Rs.	(2 weeks)	23.546	(2 weeks)	24.128	(2 weeks)	26.590	(2 weeks)	26.530	4	53.120	+ 5.446
Melbourne (month)	64.000	...	...	...	67.500	...	...	...	52	680.000	+ 62.000
Mexico (month) $	565.629	...	...	...	653.102	...	...	...	52	6.813.046	+636.076
Montevideo (month)	29.147	..	...	...	34.483	...	...	...	9	64.106	+ 8.345
Para	4.090	3.731	3.710	3.608	4.321	3.961	4.120	3.991	8	32.106	+ 2.273
Perth (W.A.)	2.208	1.953	1.962	1.944	2.430	2.161	2.189	2.196	4	7.596	+ 694
Port Elizabeth (month)	4.296	...	...	...	4.367	...	...	...	26	19.944	+ 1.279
Shanghai $	16.816	18.749	18.387	16.933	18.200	20.200	18.200	18.800	3	57.200	+ 3.131
Singapore $	10.011	10.547	10.085	9.697	10.135	11.159	11.232	10.996	4	43.522	+ 3.182
Toronto (month) $	727.130	...	...	...	845.297	...	...	...	52	8.562.600	+946.682
Winnipeg (month) $	319.900	...	...	...	361.700	...	...	...	52	3.765.384	- 64.365
ELECTRIC RAILWAYS.											
Central London	5.044	5.164	5.267	5.220	5.595	5.512	5.780	5.500	4	22.387	+ 1.692
City and South London	3.437	3.402	3.517	3.440	3.148	3.016	3.273	3.054	4	12.491	- 1.305
Great Northern and City	1.746	1.772	1.757	1.748	1.554	1.534	1.611	1.550	4	6.249	- 774
Liverpool Overhead	1.528	1.526	1.364	1.551	1.680	1.678	1.577	1.609	4	6.544	+ 575
London Electric	14.925	15.325	15.335	15.115	14.810	15.090	15.515	14.775	4	60.190	- 510
Mersey	2.171	2.143	2.072	2.067	2.328	2.224	2.266	2.191	4	9.009	+ 556
Metropolitan	17.228	17.061	17.085	17.077	16.898	16.732	16.888	16.890	4	67.408	- 1.043
Metropolitan District	12.618	12.900	12.750	12.727	13.230	13.408	13.627	13.331	4	53.596	+ 2.601

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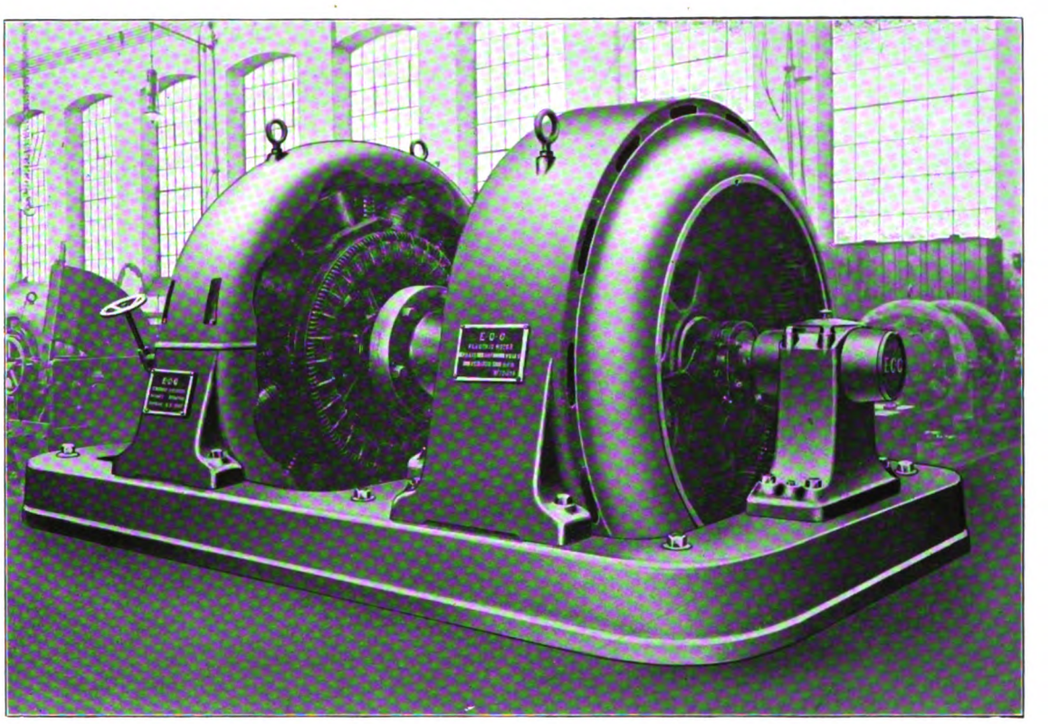
:: :: **E.C.C.** :: ::

ELECTRICAL PLANT
AND
SWITCHGEAR

OF EVERY DESCRIPTION.



600 KW. SYNCHRONOUS MOTOR-GENERATOR.

THE

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TELEPHONES—10920 Central; 2671 London Wall.
TELEGRAMS—"Concordance," London.

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LONDON.

WORKS:

TELEPHONES—75 and 430 Wolverhampton.
TELEGRAMS—"Electric," Wolverhampton.

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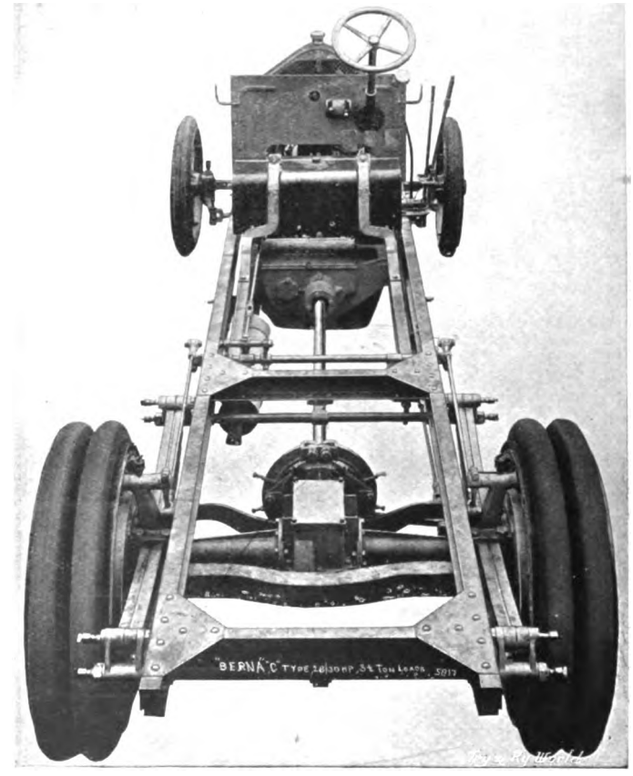

Berna 3½-Ton Chassis. Rear View Showing Differential and General Arrangement.

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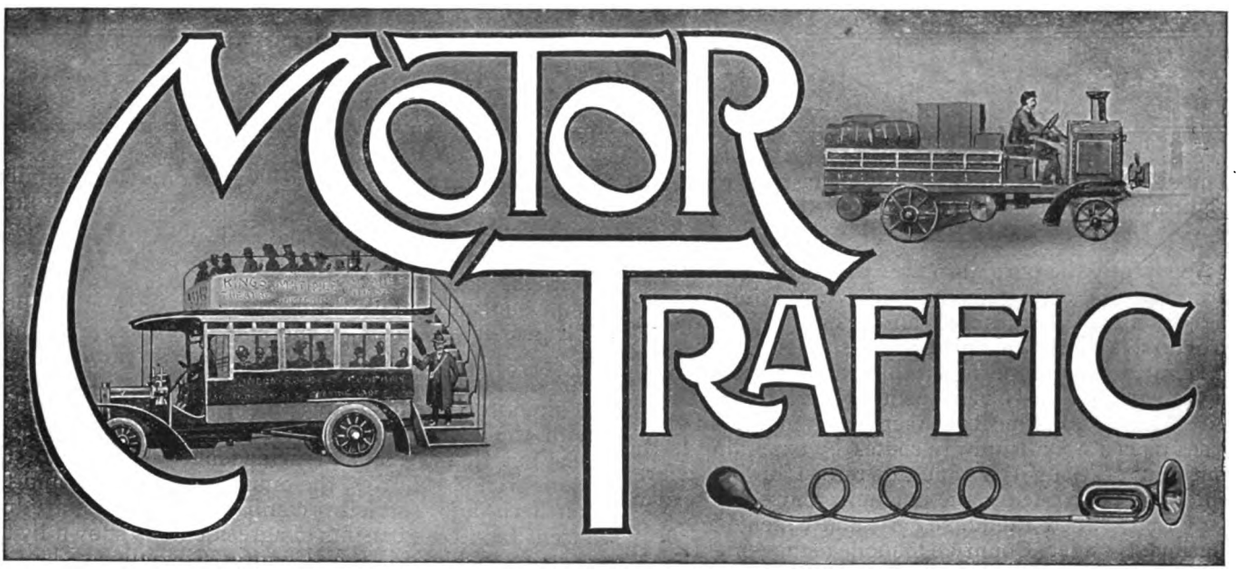

Motor chars-a-bancs capable of carrying passengers, parcels, and mails, and motor lorries for the transport of goods, should be greatly in demand in South Africa if an experiment now being tried by the South African Railways Administration proves to be successful. The new Union of South Africa is a country of vast distances and few and rough roads, while the demand for railways, as the result of nationalisation of the means of communication, has become so great that the Government find it a matter of impossibility to accede to anything like a tithe of the applications. Recognising that the conditions are such as to render the ordinary branch railway an unprofitable outlay for a more or less lengthy period, the Administration proposes to adopt a method of opening up the country and developing traffic which, as we have pointed out from time to time, has proved a success in Great Britain. We refer to the institution of road motor services, a notable instance of the supercession of such facilities by a railway having occurred last year at Holywell, the London and North Western Railway Company having run the road conveyances and constructed the railway. In December last the Commissioner of Railways for South Africa instituted a wagon and trailer for goods service between Bot River, on the Caledon line, and Hermanns and Mossel River, a distance of about 19 miles. If the experiment proves successful, the department proposes to institute a general system of road transport, to be operated by and in conjunction with the railways, the building of railway lines in the future to be limited to lines of standard gauge as far as possible, and only to be undertaken when and where the traffic is heavy enough to justify their construction.

The chief advantage urged in favour of this policy is that the cost involved in building 100 miles of branch lines would be sufficient to construct and equip with motor transport two or three times that number of miles of main roads. In the second place these roads, which would be gradually extended and linked up in all directions, would in themselves form a most valuable national asset, even after the road transport services had been replaced by railways. Thirdly, when the traffic in any district developed sufficiently to warrant the construction to a railway, the road transport vehicles and other plant could be transferred to another district. The roads to be constructed under this scheme by the local road authorities would be first-class metalled roads of a standard width of 18 ft. 6 in., well drained, and waterproofed if possible. Depots or stopping places would be established at regular intervals, and where necessary, goods sheds of a design suited to the traffic to be dealt with. The transport depots, where stores, fuel, etc., would be kept, and where running repairs would be effected, would naturally be established at the points of communication with the railway lines. Two types of motor vehicles, the general manager observes, would be necessary—one for passengers, parcels, and mails, and one for goods traffic. Speeds of from 12 to 20 miles should be possible for the passenger service, and from six to 15 miles per hour for the goods service. A telephone would be run alongside the road, and the whole service would be conducted as far as possible in accordance with railway methods. Motor works in this country are fully occupied with orders, but manufacturers will be well advised if they inquire a year hence for the results of the South African experiment. A successful report might prove sufficient justification for establishing works in South Africa, for local effort is not equal to meeting the demand for vehicles which would arise.

Motor omnibus competition with the London tramways is occupying increasing attention in view of the triennial election of the County Council next month. The financial results were discussed on January 21, and although the Progressives were not able to secure a full disclosure, enough was said by Mr. Squires, the chairman of the Highways Committee, Mr. Whittaker Thompson, a former chairman, and by Sir J. Benn, the Progressive leader, to indicate that the position is disquieting. Unfortunately it is to be feared that the facts have not reached the ratepayers, for newspapers nowadays are more intent upon giving reports of "scenes," and a partisan flavour to the insignificant accounts of the proceedings of the Council which find publicity, than they are to recording important items. The financial details which came to light indicate that the yearly accounts will show no provision for the reserve and renewals funds. Nine months ended December 31 of the present financial year have produced nothing for the reserve account, while the amount available for renewals have been depleted to an extent not revealed. An assertion was further made by Sir J. Benn that in the matter of a superannuation fund for the tramway employees the controller of the Council's finances had declared that the undertaking was not now in a position to bear the burden. This outcome is the more serious when the fact is recalled that if the Council had been courageous enough to arrive at an agreement with the London

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MOTOR TRAFFIC.

General Omnibus Company early in last year the loss might have been considerably curtailed.

Apparently the party in power were willing to discuss terms for an arrangement, but they withdrew from the discussion because of an outcry, raised by the Progressives and their newspaper supporters, that the Moderates were proposing to hand the tramways over to the companies. Consequently the Highways Committee have had to meet the increasing number of omnibuses placed upon tramway routes by extending to the southern sections the reduced return ordinary fares which were accorded to the northern routes by the company that owned the horse cars, and which have been continued under County Council management. In addition, further reductions were granted on the through running routes of the West Ham and other tramway authorities. Nevertheless the traffic returns for the nine months show a decrease of £80,000. From the ratepayers' point of view the only satisfactory feature is that for the five weeks ended January 15 the decrease was only £5,000. Thus the reduced fares are proving beneficial as regards lowering the weekly loss, but the total reduction on the year will prove none the less serious. Already, as before mentioned, the amount hitherto given to the reserve fund has been lost, and as in the year ended March 31 last £84,551 was placed to reserve and £138,151 to renewals, it is evident that for the current year the apportionment for the latter account has been encroached upon. The last financial year gave an assessment of £391,383 to income tax, and the net surplus carried to appropriation account was £222,703, as against £232,726 the previous year. An idea as to the capability of the system for meeting further competition may be gathered when we state that the renewals fund at the end of 1911-12 stood at £654,844, while the reserve fund amounted to £265,558.

A faint hope for a policy of agreement is to be gained from a perusal of the speeches of the Moderate leaders at the opening meeting at Finsbury Town Hall of that party's campaign. The remarks of Mr. Cyril Jackson, who leads the Council at Spring Gardens, if correctly reported, reveal him as unacquainted with the conditions governing public passenger vehicle running in the provinces. "Every municipality," he is represented as saying, "had suffered by the competition of motor 'buses with their tramways, but with proper regulation of the streets the 'buses should be allowed to run." The statement is correct if applied only to every municipality in the metropolitan police area. Elsewhere there is not one motor omnibus competing with tramcars; the local authority who have the control of the licensing take care not to endanger their own property. We are afraid that Mr. Jackson is relying upon an uncertain hope when he declares that in his opinion many of the 'buses would shortly be withdrawn from tramway routes. The omnibuses secure their profit by taking the cream of the traffic, for they offer no inducements in the form of reduced fares. Hearty support should be given to Mr. Jackson's plea that with proper regulation of the streets the 'buses should be allowed to run. Here he is in accord with the views of the more experienced member of his party, Mr. Whittaker Thompson, who at the meeting of the Council on January 21 expressed his belief that there is a future for the London tramways—working not in hostility to, but more in harmony with, omnibus companies. THE TRAMWAY AND RAILWAY WORLD, in its issue dated January 9, advocated an extension of the amiable relations which, under the pressure of omnibus competition, had been established between the County Council's tramways and the Metropolitan Electric Tramways. A prominent Moderate member of the Highways Committee, while sympathising with the idea, has informed us that the difficulty is to discern a direction in which an agreement can be arrived at with the Combine. The task no doubt is a difficult one, but that the united management of most of the underground railways, the omnibus companies, and the northern and southern company tramways are not insensible to the benefits of agreements is shown by the request made to the County Council as late as January 28 for the extension of the through running between Enfield and Euston from a period of one year to three years.

Glancing at the matter of road improvement as one which concerns the comfort of omnibus passengers, its importance must be insisted upon if a service is to prove profitable. It is doubtless for this reason that the directors of the Combine are credited with a willingness to bear, in addition to the petrol tax, the burden of a rating assessment, in order that they may have some claim to call upon local authorities to improve the roads. On the greater portion of the London side of the route to Croydon the 'buses, despite uneven road surfaces, are popular because of circumstances which handicap the tramcars. Delays are caused by the change from conduit to overhead running in Streatham, and by the single line working in the business thoroughfare of that suburb, while three-quarters of a mile further on passengers have to change from the London to the Croydon cars. Three years ago, when motor 'buses were less efficient than they are to-day, the extension of the London tramways to the Croydon boundary resulted in the former vehicles being withdrawn, but the advantage to-day is with the motor omnibus, which has lowered the Croydon Corporation's tramway receipts by £790 in 42 weeks, although weekday traffic has only been in progress for two months. In Croydon the tramways are assisted to some extent by civic patriotism on the part of the passengers, an aid to municipal enterprise which does not count for so much in London. The omnibus management have redoubled their attack since the refusal of the Croydon Council last month to incur an expenditure of £60,000, in order to fit their cars and track for the through running suggested by the London authority, and which has long been demanded by the passengers. The competition from the Combine has been increased by placing the popular "British" line upon this route. Hitherto they have run between Liverpool Street and Victoria.

ONE-WAY TRAFFIC THOROUGHFARES.—Westminster City Council is proposing a scheme for one-way traffic thoroughfares to be worked voluntarily. It will be remembered that two years ago the City of London Corporation obtained powers relating to specified routes. The Westminster scheme was mentioned at a meeting of the Touring Guides Committee of the Royal Automobile Club by Mr. Lyon Thomson, a member of the Council, who said the idea was to assist the movement of traffic. The Committee agreed that if this scheme should be approved by the Commissioner of Police the committee might employ certain guides to watch and, if possible, assist the traffic arrangements in connection with this experiment.

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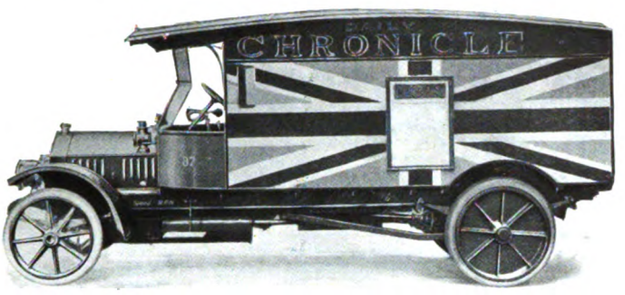
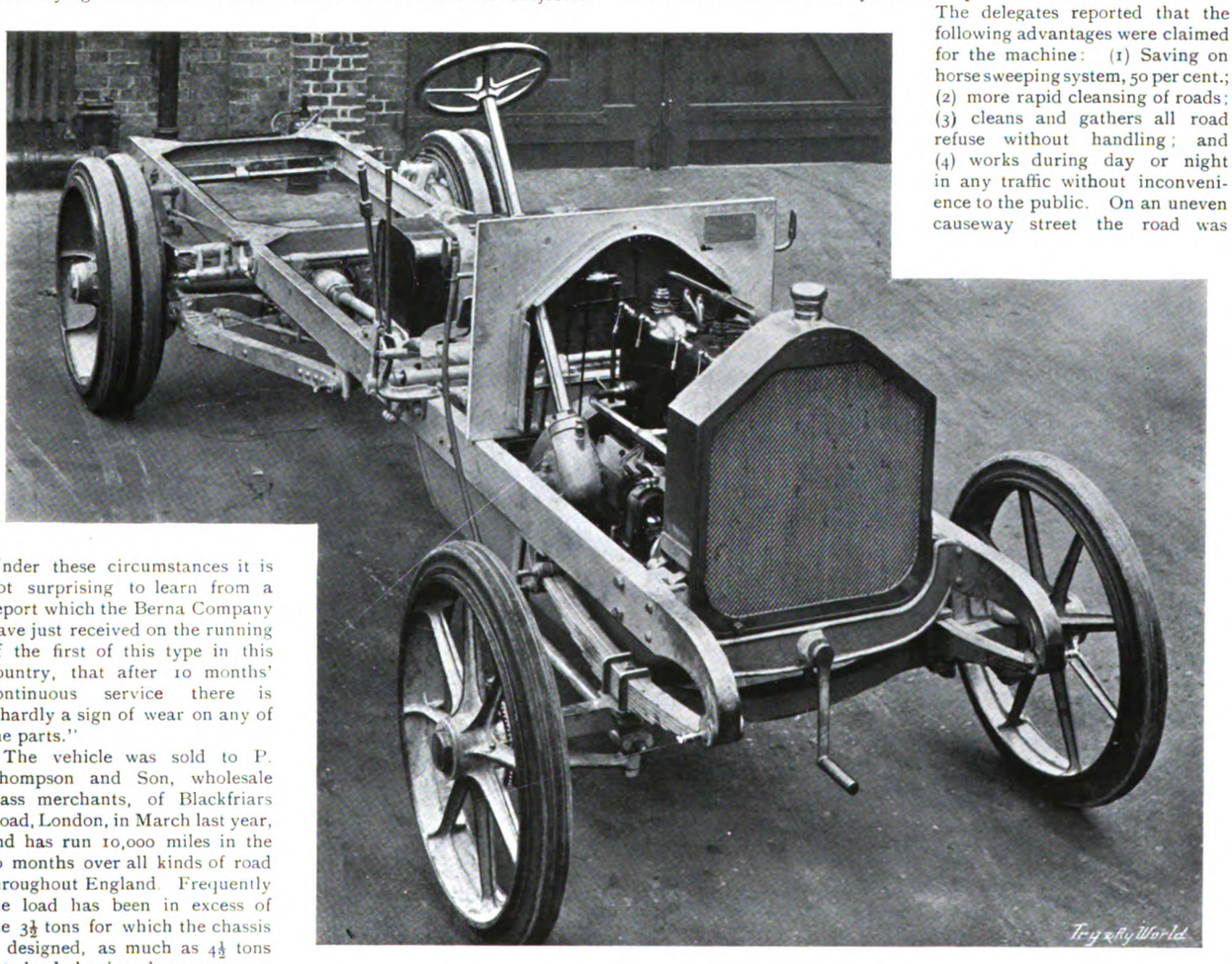
BERNA THREE AND A HALF TON CHASSIS.

The 30-H.P. chassis which the Berna Commercial Motors, Limited, placed upon the British market in the early part of last year is giving complete satisfaction, and has fully justified the claims made for it by the makers, both on account of its reliability and economy. In the



Berna 3½-ton Van Chassis.

description of this chassis, published in our issue of March 7, 1912, mention was made that it had been specially designed for hard work, and that it was the outcome of practical experience under some of the most trying conditions to which motor vehicles can be subjected.



Berna 3½-ton Lorry Chassis.

Under these circumstances it is not surprising to learn from a report which the Berna Company have just received on the running of the first of this type in this country, that after 10 months' continuous service there is "hardly a sign of wear on any of the parts."

The vehicle was sold to P. Thompson and Son, wholesale glass merchants, of Blackfriars Road, London, in March last year, and has run 10,000 miles in the 10 months over all kinds of road throughout England. Frequently the load has been in excess of the 3½ tons for which the chassis is designed, as much as 4½ tons net load having been put on, and a trailer attached with an extra two ton net load, the whole being conveyed without any trouble. Valuable testimony is given as to the absence of vibration, and also to the springing of the machine, from the fact that throughout the 10 months not one sheet of glass was broken or cracked. Not only was the petrol consumption remarkably low, but the consumption of lubricating oil was especially so. A special test of several hundred miles revealed the fact that the machine was doing from 19 to 21 miles to the gallon.

Messrs. Thompson have just had the vehicle thoroughly overhauled, and have closely examined all the working parts, with the result that they find that a little adjustment is all that is necessary. They express themselves as being thoroughly satisfied, and consider the result a "great tribute to the make and stability of the machinery." As a result of their 10 months' working Messrs. Thompson have found that the motor service is less expensive than carriage by railway, while their deliveries have been considerably expedited. In their particular case the freedom from breakage is also a most important item. The firm have decided to extend their motor services.

From the illustrations which we are able to give of the "Berna" 3½-ton chassis, and also the *Daily Chronicle* van, which is fitted with the same type chassis, a good idea of the general arrangement and appearance will be gathered. The Berna Commercial Motors, Limited, have taken space in the commercial section of the motor exhibition at Manchester this month, and their 5 and 3½-ton models will be exhibited.

MOTOR ROAD CLEANER FOR GLASGOW.

As the result of the demonstration given at Southport by the vacuum patent motor road cleaning machine, manufactured by Messrs. J. and P. Hill, of Sheffield, the Cleansing Committee of the Glasgow City Council have recommended the Corporation to purchase one of the machines. The delegates reported that the following advantages were claimed for the machine: (1) Saving on horse sweeping system, 50 per cent.; (2) more rapid cleansing of roads; (3) cleans and gathers all road refuse without handling; and (4) works during day or night in any traffic without inconvenience to the public. On an uneven causeway street the road was swept perfectly clean. Even when a quantity of large clinkers mixed with stones, etc., was thrown down the machine swept the road clear of all material.

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PROVINCIAL OMNIBUS PROPOSALS.

London Company's Offer to Brighton and Hove Councils.

Messrs. Thomas Tilling, Limited, have made an offer to the Brighton and Hove Town Councils, which has created a very favourable impression on the ratepayers. The company have offered to supply a fleet of about 40 Tilling-Stevens petrol-electric omnibuses for service in the two boroughs at agreed fares and to pay a considerable wayleave per annum for the use of the roads, or to give the local authorities a share of the profits. For three days during January a demonstration vehicle was run in the two towns, passengers being carried free of

Petrol-Electric Demonstration Omnibus at Brighton.

charge. The object of Messrs. Tillings' offer is to induce the Corporations not to carry into effect the powers which they obtained in 1912 for the installation of railless trolley car routes through the central business and suburban thoroughfares, the Brighton Corporation tramways only serving a portion of that borough. Powers were also granted for the use of motor omnibuses, which Brighton Council intend to use while the construction of the trolley routes is taking place, and during repairing and emergency periods. The Hove powers were obtained in order to prevent the Brighton Council from entering Hove, and the mayor has frequently stated since that the ratepayers would prefer the continuance of the present motor vehicles run by the Brighton and Hove General Omnibus Company. In consideration of the company withdrawing their application for railless trolley powers, the Brighton Council have agreed to pay the company £12,100 in respect of sixteen motor omnibuses, and of the railless trolley powers which the company obtained two years ago for the road to Rottingdean, a coast village outside of the Brighton boundary. A bill for the confirmation of the agreement will come before Parliament this session.

Aberdeen.—A report has been submitted to the Tramways Committee by a sub-committee recommending the obtaining of general powers to run motor 'buses within and without the city boundary, the principal routes of which would be to serve Footdee and connect Burnside with the centre of the city.

Chesterfield.—The motor omnibuses for which the Town Council have agreed to apply for Parliamentary powers, in addition to powers for railless trolley cars, are to be used for testing routes before any outlay is made for railless installations.

Dover.—The Daimler Company have informed the Tramways Committee, in reference to motor omnibuses, that a large number of municipal tramways were now employing them as feeders. In February or March a Daimler omnibus would be in the district, and it would be placed at the disposal of any of the committee or officials interested.

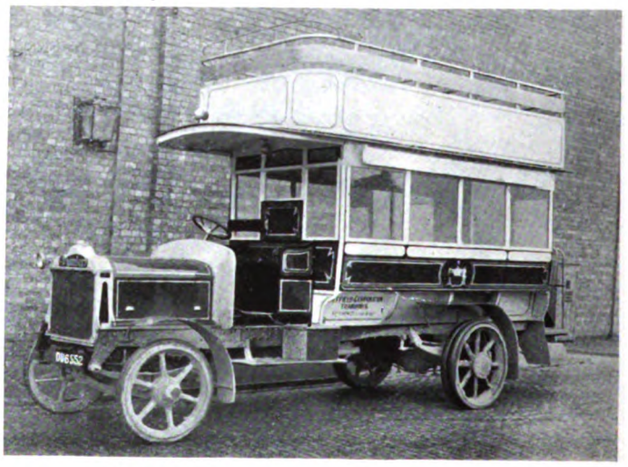
Edinburgh.—At the annual meeting of the Edinburgh and District Tramways Company on January 28, the chairman (Mr. B. Hall-Blyth, C.E.) stated that the motor omnibuses which the Corporation were going to run in the county and city would not be run in the city unless under an agreement with the company.

Glasgow.—The Tramways Committee are considering a resolution passed by the City Council asking for a report as to the advisability of acquiring, in connection with the tramway service, a number of motor omnibuses for the purpose of tapping the districts in the neighbourhood of the various tramway termini; and being utilised for the conveyance of passengers in the city at night or early morning after the service of tramway cars has ceased.

Hebburn.—The District Council have asked the Gateshead and District Tramways Company to establish a motor 'bus service between Heworth and Hebburn. Mr. Morrison, the manager of the company, has placed the matter before his directors.

Southport.—The Council have ordered two petrol-electric chars-a-bancs from Messrs. W. A. Stevens, Limited, Victoria Street, London, at the price of £900 each. At the January meeting of the Council, at which this decision was arrived at, Alderman Griffiths, chairman of the Parliamentary Committee, said the type of 'bus intended to be run was made with four windows, which could be either open or shut. Those members of the Council who had ridden in this type of car were delighted by the smoothness of their working. Councillor Morrin, chairman of the Tramways Committee, drew attention to the recommendation in Mr. Mallins' report on the tramways as to the promenade providing a source of revenue for the tramways. The committee thought that motor 'buses could be utilised. Liverpool and Newcastle Corporations were running petrol-electric 'buses in outlying districts, and the Birmingham Omnibus Company had ordered 13 in addition to the 43 they possessed. They could be run at 10d. per mile, and he was told by Mr. Stevens that in some places they had been running at 7d. If these motor 'buses had been in existence at the time that the tramways were proposed, the lines would not have been laid down in Southport.

Sheffield.—A Daimler double-deck omnibus, seating 16 persons inside and 18 on top, was put into service by the tramways department



Sheffield Corporation's Daimler Omnibus.

on January 27. Three more Daimlers are shortly expected to arrive from Coventry. These will be single-deck vehicles for service between Wincobank village and Brightside tramway terminus.

Warrington.—In response to petitions from the Whitley and Stretton Parish Councils for an extension of the Corporation tramways, the manager has been asked to report upon the cost of a petrol-electric motor omnibus service.

West Bridgford.—A decision to proceed with the promotion of a bill this session for powers to provide and work omnibuses has been arrived at by the Urban Council. Apparently so far no announcement has been made as to the result of the conference with the Nottingham Council, who have applied for powers to run motor vehicles to Bridgford.—Mr. E. Manville, who is chairman of the Society of Motor Manufacturers and Traders, has acted as expert adviser to West Bridgford Council in the scheme for running motor omnibuses, for which purpose the Council are promoting a Parliamentary bill in response to a pressing demand. Mr. Manville attended the meeting of ratepayers at which the Council's action was approved, and he gave details as to the cost of the scheme. The mover of the resolution stated that the cost of four motor omnibuses and the parts of a fifth in reserve would be not more than £4,990. Negotiations are to take place with a view to avoiding a conflict with Nottingham Council, who are also promoting a bill.

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LONDON STREET TRAFFIC INQUIRY.

When the House of Commons Committee which is considering the question of accidents due to the various forms of power street traffic in London resumed their sittings on January 7, Captain Sir J. W. Nott-Bower, chief commissioner of the City of London Police, reiterated the views of the Corporation against the running of tramcars on the surface in the City. Their objection is based purely upon the narrowness of the streets, and the impossibility of properly managing the traffic if tramways were added. Mr. Kellaway, a member of the Committee, in his examination of Captain Nott-Bower, endeavoured to show that tramways from Blackfriars Bridge to Farringdon Street would minimise congestion. Theoretically, it was agreed that this might be so, but it was very doubtful whether the omnibuses would be taken off this route in consequence of the introduction of tramways. Apart from this, however, was the serious consideration that such a tramway would have to cross from the Embankment to Queen Victoria Street, and also Ludgate Circus. Subway tramways the City authorities will not object to.

The City's Treatment of Motor Omnibuses.

The bulk of the City Police Commissioner's evidence dealt principally with motor omnibuses. Speed limits are regarded as useless in a condition of affairs where the average speed, due to the density of the traffic, can never exceed five miles an hour. Speed restriction by the aid of a very efficient police force appeals to the Commissioner as a far more efficacious way of tackling the problem. In a word, cast-iron speed limits are inimical to the interests of a great trading centre such as the City is, especially when figures of accidents show that the greater number occur with vehicles at lower speeds than seven miles an hour. The greater the congestion the more frequent the accidents, and the moral is obvious if congestion is increased through the imposition of speed limits. Motor omnibus drivers, as a general rule, he was not prepared to say were reckless, despite the outcry which is raised from time to time as to the unsafe condition of the streets His view was that if full advantage were taken of the facilities for crossing busy thoroughfares, such as using the subways and refuges, a large proportion of accidents would not take place.

Evidence Given by Two Coroners.

Dr. F. J. Waldo, coroner for the City of London and Southwark, and Mr. R. H. Wellington, deputy-coroner for the City of Westminster and for the south-western district of the County of London, gave evidence before the Committee on January 14 and 17. Each agreed that coroners' juries are too lenient in the matter of bringing in verdicts of manslaughter in the case of traffic accidents, and both also regard motor accidents as on the decline rather than otherwise, and blame the congested state of the streets more than the drivers for those accidents which do happen. Both also feel that the education of the public in crossing roads leaves much to be desired, and that much is to be attributed to carelessness on the part of pedestrians. One thing seems likely to come out of the inquiry, and that is that motor car drivers will be bound to slow up to allow pedestrians to cross roadways, and not to chance the pedestrian being out of the way by the time the car reaches the spot where he was when the hooter was sounded. Dr. Waldo shares the view that speed limits in crowded thoroughfares are useless, and both witnesses strongly urge an increase of refuges in busy thoroughfares, and also underground crossings. The gearing of motor 'buses so that they cannot exceed the legal maximum of 12 miles an hour was another suggestion from Dr. Waldo, and is the outcome of evidence before him that motor 'buses can run at any speed up to 20 miles an hour. Somewhat conflicting views were expressed as to the relative dangers of tramcars and 'buses, for whilst figures show that the former are much less dangerous to life, yet it was felt that being on a fixed line they cause congestion, and may possibly create accidents in that way which could not, in statistics, be attributed to them.

A Representative of Private Car Owners.

Lord Montagu of Beaulieu, one of the pioneers of motor traffic, whilst not wishing to shield motor drivers in any way, thinks it is the education of the public in the new conditions of street traffic that needs to be taken in hand first. He would abolish speed limits, and argued in favour of the publication of official rules of the road. At present there was no statutory authority behind the observance of the rules of the road, the only mention of keeping to the left being in an Act of 1835. He would be particularly severe on reckless driving, but on the other hand he thinks the Motor Car Act could be modified in the matter of trivial offences. He suggested that moving stairways in subways should be provided to enable pedestrians to cross busy points.

A keen exchange of views took place between Mr. Kellaway, M.P., and Lord Montagu on the relative danger of motor 'buses and tramcars. Mr. Kellaway called attention to the fact that in 1907 in London 1,200 'buses killed 35 people, or one for every 34 'buses; in 1912, 2,400 'buses killed 138 people, or one for every 17 'buses. Each vehicle had therefore become twice as deadly. Lord Montagu replied that the increased number of accidents was due to the greater use by motor 'buses of the streets, and the greater mileage which they run, and also to the fact that they run in more crowded streets than they used to do He anticipated the time when tramways would be considered things of the past, an opinion which he said he expressed as an engineer and a student of traffic. The apparent safety of the tramcar, in the matter of fatalities, was on account of the life-guard, and many motor 'bus fatalities would be mere accidents if a satisfactory life-guard could be fitted. Lord Montagu desired to see an independent traffic authority set up, upon which was represented all the various bodies concerned. If the County Council were to undertake this duty there would be bound to enter a little prejudice in favour of the tramways.

Sir E. Henry and Tramway Traffic.

Sir Edward Henry, chief commissioner of the Metropolitan Police, gave evidence on January 21. A large part of his evidence and examination by members of the Committee had relation to motor 'buses *v.* tramways, and his arguments on this point arose out of figures which he handed in, comparing the number of accidents in streets where there are tramways with those in streets where tramways do not exist. During the 2¾ years ended September 30, 1912, there were 292 fatal accidents due to motor traction in the 149 miles of streets in the County of London where there are tramways, and 199 fatal accidents in 215 miles of streets selected as being comparable, and where there are no tramways. He drew the deduction that the existence of tramlines increases danger, because a passenger is landed in the middle of the street without any refuge. The fact that the lines are so near together precludes any possibility of refuges being placed between them, and it is by the construction of more refuges that the Commissioner believes the problem will be to a large extent solved. Mr. Kellaway argued with the Commissioner that his deduction was a wrong one, and contended that the extra accidents on roads containing tramways were due to the increase in the number of motor omnibuses which has been run over these streets. Before Mr. Kellaway and several other members would accept the views put forward by Sir Edward Henry, they asked to have the figures calculated out per mile of tramway, and per mile of street where there are no tramways. Sir Edward stated that the incidence of fatalities on tramway routes is twice as heavy as on non-tramway routes, not that the tramways killed more people, because the angle of obscuration of a tramcar is so large as to make it almost impossible for anybody to cross behind or in front of one with safety from the other traffic, which they are unable to see. The angle of obscuration was also discussed in relation to trailer cars. Two vehicles coupled together, weighing nearly 30 tons, and running at a rate of 16 miles an hour, was just the condition of things, said Sir Edward, which would promote accidents, and he was not aware that this innovation had been introduced into any large system in the United Kingdom.

Chief Commissioner's "Sole Object."

Mr. Kellaway put the question: "I think you do not like tramways," but Sir Edward replied indignantly that he objected to such a statement. Mr. Kellaway observed that from the evidence which the Commissioner had given there seemed to be no other interpretation. Sir Edward replied that he by no means objected to tramways, and that for certain streets he looked upon them most favourably, because they helped to solve the housing problem. Nevertheless, in certain other classes of streets they were a cause of danger, as he had already mentioned. Mr. Kellaway thereupon informed Sir Edward that he was pleased to know that he was not unsympathetic towards tramways. A point brought out by Mr. Kellaway was one that, whereas the number of accidents in London per month in 1910 was 17, this had risen to 28 in 1912, due, he contended, to the large increase in the number of motor omnibuses, because the tramway position was very little different now to years ago. Sir Edward persisted in his argument that the statistics compiled by Scotland Yard all go to show that no matter from what cause, the accidents in tramway streets are more numerous than in non-tramway streets. He hardly agreed that the increase was altogether due to motor 'buses, for many of the additional 'buses put on the streets during the past year or two had been put upon new routes where tramways did not exist, and he believed that even deducting the accidents on tramway routes due to motor omnibuses, the remainder would be found to equal those on non-tramway routes. Another point made by Mr. Kellaway was that as omnibus drivers were paid by the journey, and as the directors appeared to draw up the time tables in such a manner as to leave insufficient time without the drivers finding it necessary to exceed the speed limit, the responsibility for accidents

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MOTOR TRAFFIC.

should be brought against the directors. The same member of the Committee quoted figures given to him in the House of Commons that last year motor omnibuses killed 160 people, and tramways only 27. Sir Edward explained that his sole object was to prevent the lamentable loss of life which is now going on, and that he did not care two straws whether tramways or omnibuses or neither survived as long as the safety of the public could be reasonably ensured, and that it is purely from the traffic aspect of the question that he holds the views he does with regard to tramways. He thought the whole question of joint stopping places for tramways and 'buses should be thoroughly inquired into. Among other points mentioned was the opinion that Section 1 of the Motor Act, 1903, should be made applicable to tramcars and trolley omnibuses.

STOPPING PLACES AND WEIGHT OF OMNIBUSES.

Another suggestion which commended itself to Sir E. Henry was that at all fixed stopping places for tramcars motor 'buses should be compelled also to stop, but with the nose of the 'bus a yard or so behind the rear of the tramcar, in order to give freedom of movement for the tramcar passengers, and, of course, to prevent accidents to them. The vigilance of the Public Carriage Department is shown by the fact that last year no less than 31,563 motor cabs and omnibuses were ordered off the streets on account of temporary defects, which it was thought made them unsafe as public vehicles. The officers of this department go round to garages frequently and test the condition of the brakes and steering gear. The Chief Commissioner did not go into detail as to the construction of 'buses, this matter being left to Mr. Worby Beaumont, the technical adviser to the Public Carriage Department, but Sir Edward mentioned that in spite of the unladen weight of 'buses having been reduced from 5 tons to 3½ tons three years ago, there are still complaints that they were too heavy. He did not see any prospect of great reduction in weight unless the carrying capacity was also to be reduced. The expectations of the Local Government Board when they revised their regulations in 1909 were that the lighter vehicle with rubber tyres would not cause any more, if as much, damage to the roads than a horse 'bus, but it was something of a mystery that these vehicles should cause as much damage to the roads as they undoubtedly did. He was not inclined to attribute the number of accidents to carelessness on the part of the drivers, with whom, however, so far as public service vehicles are concerned, he would be very strict on the question of sobriety. The Chairman suggested that as Parliament had seen fit to sanction tramways down the centre of the road it was surely right to assume that it was intended that other traffic should be so regulated as not to cause danger to the tramway passengers getting on or off the cars

Sir Alexander Bruce, chief of the Public Carriage Department at Scotland Yard, was called on January 23, but the Committee were forced to make an early adjournment owing to the absence of a quorum.

CONFUSED THINKING AT SCOTLAND YARD.

The whole of the sittings on January 28 and 30 were occupied with evidence from Superintendent A. Bassom, of the Public Carriage Department. At the first of these sittings, his evidence was largely concerned with explaining the methods which Scotland Yard have for testing motor 'buses in particular. On both occasions there were a large number of detached references to tramway matters, and it is interesting to draw attention to these, in view of the active part which Superintendent Bassom has taken in regard to London tramway schemes when before Parliament Whilst the superintendent's evidence exhibited antipathy to tramways when viewed purely from the traffic point of view, he nevertheless endeavoured to show that tramcars had certain advantages. For instance, he admitted that tramcar brakes are stronger than motor omnibus brakes, and that there have been less accidents from tramways than from motor 'buses, although this latter he attributed to the fact that the 'buses ran closer to the kerb than did the cars. He admitted, too, that the greater carrying capacity of tramcars, as compared with motor 'buses, is of considerable value. A curious argument to account for street accidents was that owing to the maximum legal speed that the tramcar could run being 16 miles per hour, a motor vehicle would frequently, for the purpose of passing a tramcar, increase its speed to beyond the legal limit of 12 miles per hour, and this is put forward as an argument in favour of reducing the speeds of tramcars. It was also definitely stated that in some parts of London the maximum speeds of tramcars allowed by the Board of Trade are excessive, having in view the traffic conditions. Again, on this same point there was the double-barrelled argument that whereas the higher speed of tramcars created accidents for the reasons just mentioned, there is apparently a general agreement of the police witnesses that the greater number of accidents are caused by slow-moving traffic, and several members of the Committee could not resist pointing out how inconsistent these answers are.

The figures of tramway accidents on the London County Council Tramways show a decrease, there being 11 in 1910, 14 in 1911, and 9 in 1912, and Superintendent Bassom was generous enough to agree that this is due to the efficiency of the management. It is interesting to note that there are now about 80 petrol-electric motor omnibuses on London streets. The rule of the road as to passing tramcars came in for considerable comment. The police seem to think that if it were laid down that all traffic should pass a standing tramcar on the off side there would be accidents, and as there are also accidents from ordinary traffic being allowed to pass on the near side of a standing tramcar, it seems difficult to know what to suggest. Indeed, this point of view has struck many of the committeemen, and Mr. Collins put the direct question to Superintendent Bassom that as, according to the police, it would be dangerous for tramways to be near the kerb, and also dangerous in the centre of the road, what solution would Scotland Yard offer. He only, however, received the non-committal reply that whilst it would be safer from the point of view of tramway passengers that the car should pull up to the kerb, it would involve a blockage of the traffic, and so possibly lead to other accidents. Scotland Yard have now for their inspection a 'bus with life-guards on, and the Committee propose to inspect this.

LONDON TRAFFIC WAR.

THE EFFECT ON THE TRAMWAY FINANCES.

At the meeting of the London County Council on January 21 a discussion was started by Sir John Benn on the falling off of the traffic receipts of the tramways.

Mr. W. J. Squires, chairman of the Highways Committee, said that there was nothing to be uneasy about. True, they were £80,000 back on the returns as compared with the corresponding period last year, and during the last five weeks the receipts had decreased by some £5,000. It was patent the committee had very hard work at the moment. In face of very severe omnibus competition, which they were doing their best to combat, he hoped Sir John would not press for a full statement of the financial position.

Mr. Whitaker Thompson (a former chairman of the Highways Committee) said he believed that there was a future for the tramways in London—working not necessarily in hostility to, but perhaps more in harmony with, omnibus companies than was the case at present. A time would probably come when the tramways would be treated more reasonably by the local authorities. He regretted as much as any other member of the Council that upon the figures before them there would be nothing for the reserve fund, and that there would not be what they expected there should be for the renewals account.

Mr. W. C. Johnson asked the amounts on which the tramways undertaking was assessed for income tax under Schedule D for the last five years, and against how many of these assessments the Council had appealed.

Mr. R. C. Norman, chairman of the Finance Committee, replied that the amounts for the five years from 1907-8 were respectively: £211,553, £326,585, £168,218, £216,076, and £391,383. There had not been any appeals.

Mr. B. B. Evans asked what were the total amounts of the tramway renewals and reserve funds, the amounts which had been charged to those funds, and the present balances.

Mr. R. C. Norman replied that the totals, including accrued dividends, were: Renewals fund, £719,840, and general reserve fund, £292,545; expenditure out of renewals fund amounted to £64,995, leaving a balance of £654,844; out of general reserve £26,988 had been spent, leaving a balance of £265,557. £534,792 had been charged to the tramways account for street widenings, including £40,576 paid to tramway companies in respect of street improvements, and the resulting debt charges had fallen on the tramway revenue.

PARIS OMNIBUS BOND ISSUE.

The Paris General Omnibus Company, who completed their omnibus system on January 1, are about to issue 70,000 new four per cent. bonds, each of 500f., which will be redeemable in 36 annual drawings, the first of which will take place in 1916.

The last horse omnibus disappeared from Paris on January 15, when an amusing "funeral" was organised by certain automobile firms. The last horse omnibus went from St. Sulpice, on the left bank of the Seine, to La Villette. Over a score of motor cars followed the omnibus on its last journey. The old driver, it seems, for 35 years had done the journey from St. Sulpice to La Villette.

There is now only a single line of horse tramways in service, viz., that from Pantin to the Opera, electric traction having been installed on all other routes.

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MOTOR TRAFFIC.

MILNES-DAIMLER NEW MODELS.

Milnes-Daimler-Mercedes, Limited, have just introduced two further models of their new series, viz., a 5-ton chassis fitted with a 35-H.P. engine, and a 3-ton chassis fitted with a 30-H.P. engine. As explained in our issue dated August 8, 1912, when dealing with the new 4 and 1-ton models the whole of the Milnes-Daimler machines are being redesigned in accordance with modern practice. While some of the old features are retained a number of improvements have been incorporated.

The engines in all the new types are of an entirely new design; the inlet and exhaust valves are interchangeable and are placed overhead in a most accessible position. The frames are of a heavier section than formerly, and are considerably narrower. The length of the 3-ton model has been extended in order that it may take a long single-deck omnibus body, a type of vehicle which, we understand, this chassis is specially suited for. The selling price of the 3-ton chassis, including tyres, is £650, and that of the 5-ton £760. Both these models will be on show at the North of England Motor Exhibition at Manchester.

NORTH OF ENGLAND MOTOR SHOW.

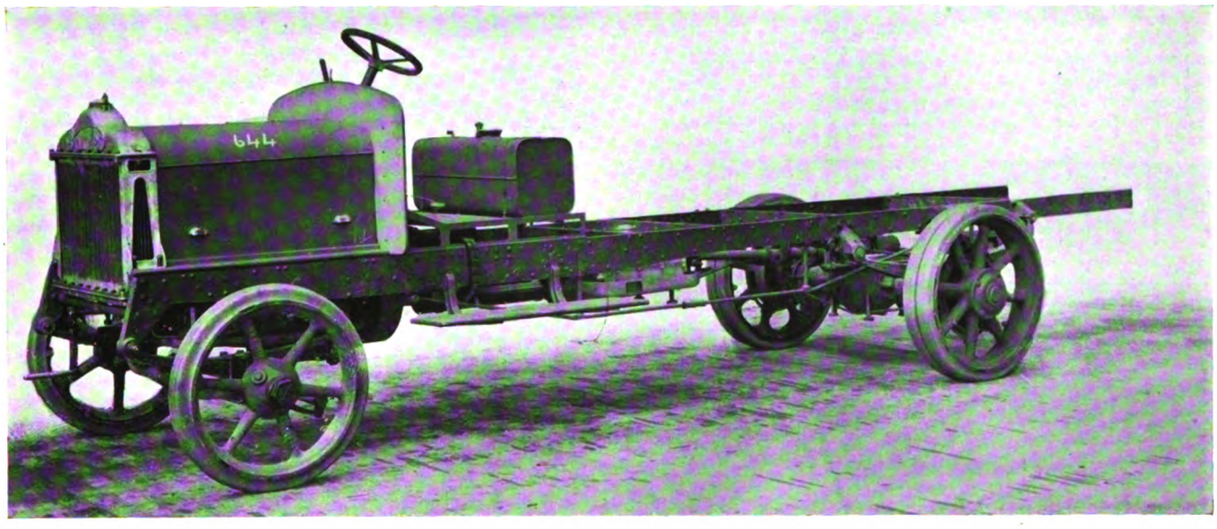
The North of England Motor Exhibition will be held in Manchester on February 14-22, and judging by the rapid manner in which the space has been taken up, the show should prove a success. From the industrial vehicle standpoint, the arrangements are far in advance of any previous year. Hitherto, the pleasure car side has quite overshadowed the industrial section, but on the present occasion the two interests will be separately catered for in different buildings. The pleasure car section will occupy the whole of the exhibition buildings at Rusholme, while the industrial vehicles will be housed at the City Exhibition Hall, Deansgate, the site of the successful exhibition organised by the Manchester and District Motor Traders in February, 1910.

Amongst the manufacturers who are exhibiting are the following:

Albion Motor Car Company, Limited—32-H.P. chars-a-banc and two light delivery vans.

Austin Motor Car Company, Limited—15-H.P. motor ambulance and a delivery van on a similar chassis

Berna Industrial Motors, Ltd.—5-ton platform lorry and 3½-ton chassis.



Daimler Model for the Manchester Exhibition.

Clayton and Company (Huddersfield), Limited—5-ton tipping wagon, 40-H.P. chars-a-banc, 2½-ton lorry and 16-H.P. chassis.

Daimler Company, Limited—40-H.P. chars-a-banc, 4-ton lorry and 3½-ton lorry. A standard double-deck omnibus of the latest Daimler type will also be available for demonstration purposes.

Halley's Industrial Motors, Limited—5-ton lorry, 3-ton chassis, and 25-H.P. delivery van.

Maudslay Motors, Limited—32-H.P. chars-a-banc and 40-H.P. chassis.

J. and E. H:'l, Limited—32-H.P. lorry.

Other exhibitors include Shrewsbury and Challiner, complete range of solid tyres; Peter Union, solid tyres; Avon Rubber Company, solid tyres; St. Helen's Cable Company, solid tyres; Coventry Chain Company, Limited; Dunlop Rubber Company, Limited; Straker and Squire; Hans Renold, Limited; Dook-Swain, etc.

GEARLESS MOTOR OMNIBUS COMPANY.

At the adjourned ordinary general meeting of the shareholders of the Gearless Motor Omnibus Company, Limited, on January 30, held at the offices of the company, 1, Kingsway, W.C., Mr. E. Manville moved the adoption of the report. As the shareholders were well aware, the position in regard to the omnibus traffic of London had during the last few years largely fallen into the hands of the London General Omnibus Company. The directors were therefore glad to be able to report that they had succeeded in coming to an arrangement with that company whereby the Gearless Company was entitled for a period of at least 30 years to possess and run 20 omnibuses on the streets of London. These would be run as a portion of the London General Omnibus Company's fleet, and would be maintained by that company, and be credited with their proportion of the average receipts of the whole of the fleet. To enable the company to purchase a sufficient number of omnibuses in addition to the 10 the Daimler Company were under contract to supply, so as to have 20 running, the London and Suburban Traction Company, Limited, had agreed to subscribe for 10,000 ordinary shares of £1 each at par. The Daimler Company had also agreed to cancel the indebtedness of the Gearless Company to it by the allotment of 2,000 ordinary shares fully paid up, and the legal proceedings previously referred to had been abandoned. The directors believed that this arrangement would at once put the company in a profit-earning position. The report was adopted.

Solex Radiators.—The new type of radiator, which was described in this journal on January 9, is being introduced into this country by Messrs. S. Wolf and Company, of Southwark Street, London, who have the sole rights for Great Britain and the Colonies, both for the radiator and the Solex carburettor.

THE USE OF PARAFFIN AS FUEL.

The Standard Carburettor Company, Limited, 171, Queen Victoria Street, E.C., are running a car in London to demonstrate the suitability of paraffin as fuel for motor cars when fitted with a suitable carburettor. The vehicle bears the inscription, "This car is running on paraffin." In addition to the relative cheapness of paraffin this oil may be stored safely in large quantities, while its high efficiency is shown by the statement that an engine which will run 10 miles on a gallon of petrol will cover from 15 to 20 miles on one gallon of paraffin. As to the cost of conversion it is said that it ranges from £10 to £15, according to size of the car.

The organisers of the taxi drivers' strike, which began in London in January, appear to be hopeful that a scheme of co-operative ownership will be established under the control of the union. It is stated that a proposal has been made to introduce a paraffin carburettor which would reduce the purchase price of 15 to 20-H.P. taxi cabs to about £300.

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MOTOR TRAFFIC.

MOTOR TRAFFIC NOTES.

MESSRS. W. A. STEVENS, LIMITED, have received orders from Southport and Oldham Corporations for petrol-electric omnibuses.

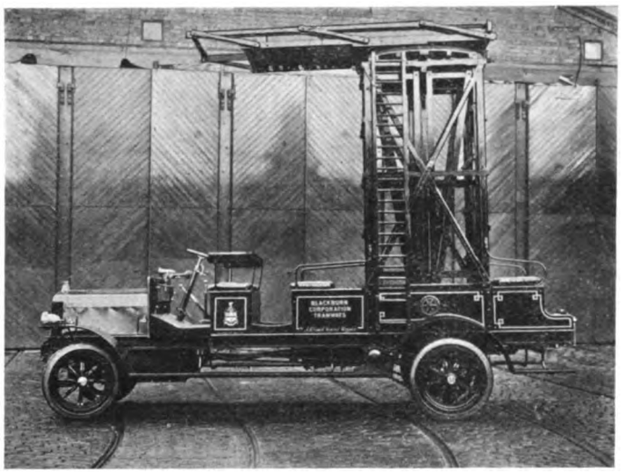
THREE-WHEEL VEHICLE FOR POSTAL WORK.—A motor bicycle, to which a carrier side car is attached, in use for country postal collection and delivery on stiff routes between Corley, Arley, and Coventry, has displaced two pedal cyclists and a horse, cart, and driver.

MOTOR OMNIBUS PROPOSAL FOR TORONTO.—An application has been made to Toronto City Council by Mr. G. Reid, on behalf of a British syndicate, for a franchise to work 50 motor omnibuses from October next. There are many parts of the city not served by tramcars.

BRITISH ELECTRO-MOBILE COMPANY.—The profits for the past year were £576. The directors are negotiating with Messrs. Opel regarding the concession for the manufacture of their car, and when these negotiations are completed a scheme for the reconstruction of the company will be put before the shareholders.

LONDON'S TRAFFIC FATALITIES.—The directors of the London General Omnibus Company are inserting advertisements in the daily newspapers asking the public to co-operate with them in reducing the number of accidents occurring in London streets, and inviting people to send all possible suggestions to the company.

MORE FIREMEN'S HORSES DISPLACED.—The approaching delivery of four motor cars purchased by the London County Council, for the use of superintendents in the fire brigade, will displace four horses supplied on hire, thereby reducing the cost of horse hire by £277 a year. For the four coachmen four firemen are to be substituted.



Halley Derrick for Blackburn Tramways.

CHASSIS REQUIRED FOR A TOWER WAGON.—Aberdeen Tramways Committee have remitted to the manager and the convener the question of purchasing a new chassis for the motor tower wagon. Twelve additional sets of storm screens for motormen are to be purchased, at a cost of £60, so that the whole of the cars may be equipped with the screens.

UNITED STATES MOTOR CAR OUTPUT FOR 1913.—The probable output of pleasure cars by United States manufacturers in 1913 is placed at 627,650, or more than twice the estimated output (250,000 to 285,000) for 1912. One of the largest companies have arrranged to produce 200,000 cars as against 75,000 in 1912. Although some of the most expensive types of car are being sold at an increased price, owing to better finish and fittings, a great number of machines are now sold at reduced prices.

COMPETITION FEARED FROM RAILWAY MOTOR OMNIBUSES.—Plymouth Tramways Committee have directed the town clerk to communicate with the London and South Western Railway Company with reference to the clause contained in their Parliamentary bill asking for power to provide and work omnibuses and other road vehicles in connection with or in extension of their railway system or otherwise. The committee suggested that the clause should either be modified or withdrawn, so as to obviate competition with tramways.

MOTOR TRAFFIC AND THAMES BRIDGES.—Since a motor omnibus displaced a length of the massive railings of Waterloo Bridge, the authorities have begun to pay attention to the whole length of the railings. At Richmond a public meeting has asked the responsible authorities to improve the means of communication between Richmond and Twickenham owing to the motor 'bus and char-a-banc traffic carried by Richmond Bridge. The Mayor expressed the hope that it would not be left for a motor vehicle to come into contact with the weak parapet before action was taken.

MOTOR OMNIBUS SERVICE INAUGURATED AT LOUGHBOROUGH.—Two motor omnibuses supplied from the Brush Company's works at Loughborough were placed in local service on January 9, a company having been formed to work the undertaking. The Mayor acted as driver of the first omnibus, and prior to partaking of tea 256 shareholders and friends made trips in the vehicles Mr. W. F. Charles, the chairman of the company, mentioned that in their arrangements the directors had received valuable assistance from Mr. W. H. Allen, the borough electrical engineer.

SCOTTISH MOTOR EXHIBITION.—This annual event took place at Edinburgh from January 24 to February 1. This year the commercial vehicle was excluded. The Continental Tyre Company's detachable rim, which created interest at Olympia, was shown at that company's stand, where the exhibits also comprised a full range of the four famous patterns of the Continental tyre. New premises have recently been opened by the company at 71, Mitchell Street, Glasgow. Another prominent stand was that of the Dunlop Rubber Company, whose wire detachable wheel and detachable rim have been widely adopted by a large number of firms and private owners.

PROPOSED LOCAL TAX ON MOTOR LORRIES.—In their 1913 Parliamentary bill the Bradford Corporation originally sought powers to levy local charges upon heavy commercial vehicles, as, for example, the rate of £16 per annum for a 5-ton rubber-tyred lorry, and £40 per annum in respect of a 5-ton steel-tyred lorry. Other charges for lighter machines were roughly in proportion. The Commercial Motor Users' Association took steps to organise effective opposition in conjunction with the Royal Automobile Club and the Bradford Automobile Club, and meetings of the local owners were called, but at the last moment the Corporation have announced their intention of withdrawing the clauses.

NEW MOTOR OMNIBUS SERVICES IN THE PROVINCES.—For the purpose of feeding the tramways with traffic from districts not now provided with means of locomotion, Southport Council on January 14 decided to purchase two motor omnibuses at £900 each. Halifax Tramways Committee on January 13 inaugurated a second service of Daimler single-deck omnibuses, of the type illustrated in our issue dated December 12 last. The district served is Siddal, within the borough. A decision has also been arrived at to put on an omnibus to Cragg Vale, the vice-chairman of Mytholmroyd Council having deposited £100, out of which sum the Corporation have the right to recoup themselves in case there is a loss over the running.

THE COMPETITION AT CROYDON.—At the January meeting of Croydon Council the Tramways Committee reported that they had had under consideration proposals submitted by the London County Council for through running of tramcars in place of through booking between London and Croydon, but having regard to the capital expenditure (estimated at £60,000) which would be involved in adapting the Croydon system to suit the London County Council cars, it was recommended that the proposals be not entertained at present. The report was adopted after discussion. Since the first week in December the London General Omnibus Company have resumed their everyday running over the London and Croydon tramways, and the competition is very keen.

MANCHESTER CORPORATION TRAMWAYS.

MOTOR OMNIBUSES.

The Tramways Committee of the Manchester Corporation are prepared to receive tenders for the supply and delivery of motor 'buses, complete.

Conditions of contract and forms of tender may be obtained on application to Mr. J. M. McElroy, general manager, Corporation Tramways, 55, Piccadilly, Manchester. Tenders are to be addressed to the Chairman of the Tramways Committee, 55, Piccadilly, Manchester, endorsed "Tender for Motor 'Buses," and must be received not later than 10 a.m. on Tuesday, the 18th February, 1913. The committee do not bind themselves to accept the lowest or any tender.

THOMAS HUDSON,
Town Clerk.

Town Hall, Manchester,
3rd February, 1913.

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THE Tramway & Railway World

A REVIEW OF CURRENT PROGRESS IN ELECTRIC AND OTHER TRACTION

ESTABLISHED 1892. LONDON, MARCH 13, 1913. VOL. XXXIII.

GREATER LONDON:

ITS AREA, POPULATION, AND TRAFFIC.

BY A. J. LAWSON, M.INST.C.E.

The City of London contains 672·7 acres, or 1·05 square miles. The County of London, as defined by the Act of 1888, contains within its boundaries the City of Westminster and 27 metropolitan boroughs, as delineated in the Act of 1899; and its area, including land and inland water, is 74,816·3 acres, or a fraction over 116·9 square miles. Greater London, or the area under charge of the Metropolitan Police (2 and 3 Victoria, chap. xlvii.), includes, in addition to the County of London, the outer ring, or outer London, which has an area of 368,603 acres, or almost 576 square miles, land and inland water only. Including tidal water, the area of Greater London and the City is generally taken as being 700 square miles in extent. Greater London is contained within a radius of 15 miles from Charing Cross. Its extreme points are Colney Heath, Hertfordshire, on the north; Mogador Heath, Surrey, on the south; Lark Hall, Essex, on the east; and Staines Moor, Middlesex, on the west.

On April 1, 1911, the population of these areas was:

City of London	19,657	18,740 per sq. mile.
County of London..	4,503,304	38,490 " "
Outer ring	2,730,002	4,740 " "
Total..	7,252,963	10,361 (average).

The rate of increase in the preceding 10 years was about 1·02 per cent. per annum.

But the population of the city and county, or, as it is called, the Administrative County of London, had fallen by 13,306 persons below the total of 4,536,267 in 1901—notwithstanding the large increases of 79,480 in Wandsworth, 33,348 in Lewisham, and the smaller additions of 16,036 in Fulham and lesser numbers in six other boroughs—owing to the greater total diminution which had taken place in the Cities of London and Westminster and 18 other boroughs, as shown in the accompanying table.

INCREASE.			
Wandsworth	79,480	Hackney	3,477
Lewisham	33,348	Camberwell	2,018
Fulham	16,036	Greenwich	207
Hammersmith	9,364		
Woolwich	4,225	Total	151,723
Hampstead	3,568		

DECREASE.			
City	7,266	Poplar	6,373
Westminster	22,734	Bermondsey	4,800
Stepney	18,576	Kensington	4,226
St. Pancras	16,864	Lambeth	3,769
St. Marylebone	15,080	Paddington	1,400
Southwark	14,229	Bethnal Green	1,398
Finsbury	13,487	Battersea	1,114
Holborn	10,069	Deptford	900
Islington	7,568	Stoke Newington ..	564
Chelsea	7,438		
Shoreditch	7,174	Total	165,029

GROWTH OF POPULATION.

The following figures, taken from the Registrar General's returns, give the particulars at the end of each decennial period since 1801 (the year of the first census) of the population of the city, county, outer circle, and totals for Greater London:

Year.	City.	County.	Total City and County.	Outer London.	Total Greater London.
1801	128,129	831,181	959,310	155,334	1,114,644
1811	120,343	1,019,012	1,139,355	184,544	1,323,899
1821	124,137	1,255,406	1,379,543	216,808	1,596,351
1831	122,491	1,533,091	1,655,582	247,990	1,903,572
1841	123,563	1,825,714	1,949,277	286,067	2,235,344
1851	127,819	2,235,522	2,363,341	317,594	2,680,935
1861	112,013	2,696,481	2,808,494	414,226	3,222,720
1871	74,844	3,186,552	3,261,396	624,245	3,885,641
1881	50,569	3,779,728	3,830,297	936,364	4,766,661
1891	37,705	4,199,252	4,227,954	1,405,852	5,633,806
1901	26,923	4,509,344	4,536,267	2,045,135	6,581,402
1911	19,657	4,503,304	4,522,961	2,730,002	7,252,963

From the above it will be seen that the changes during the past 20 years have been as under:

1891 to 1901	− 10,782	+ 319,092	+ 308,273	+ 639,253	+ 947,596
1901 to 1911	− 7,266	− 6,040	− 13,306	+ 684,867	+ 671,561

As a matter of interest and for convenient reference it may be mentioned that the most authentic figures in regard to London's population in the 16th, 17th, and 18th centuries are as follows:

1535 ..	62,400	1661 ..	460,000
1563 ..	93,276	1687 ..	530,000
1580 ..	123,934	1700 ..	574,350
1595 ..	152,478	1750 ..	676,250
1605 ..	224,275		

A census of the City's day population has been taken on four occasions, and the following results, which must, however, be regarded as only approximate, were obtained:

1866 ..	283,520	1891 ..	301,384
1881 ..	261,061	1911 ..	364,061

The extraordinary decrease in the rate of growth of Greater London in the period 1901-1911 is largely due to the removal of the business of shipbuilding, engineering, and allied works from the London district, among which may be mentioned Yarrow's, Thorneycroft's, and the South Western Railway Company's works at Nine Elms, and the shutting down of Maudsley, Son,

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and Fields, Penn and Sons, and now the Thames Ironworks and Shipbuilding Company, out of many others whose continuation on Thames side has been rendered impossible by the greater cost of raw material, labour troubles, high wages in comparison with other centres, and most extortionate rates. Added to other difficulties, neither capital nor labour has been wisely directed in recent years.

Traffic.

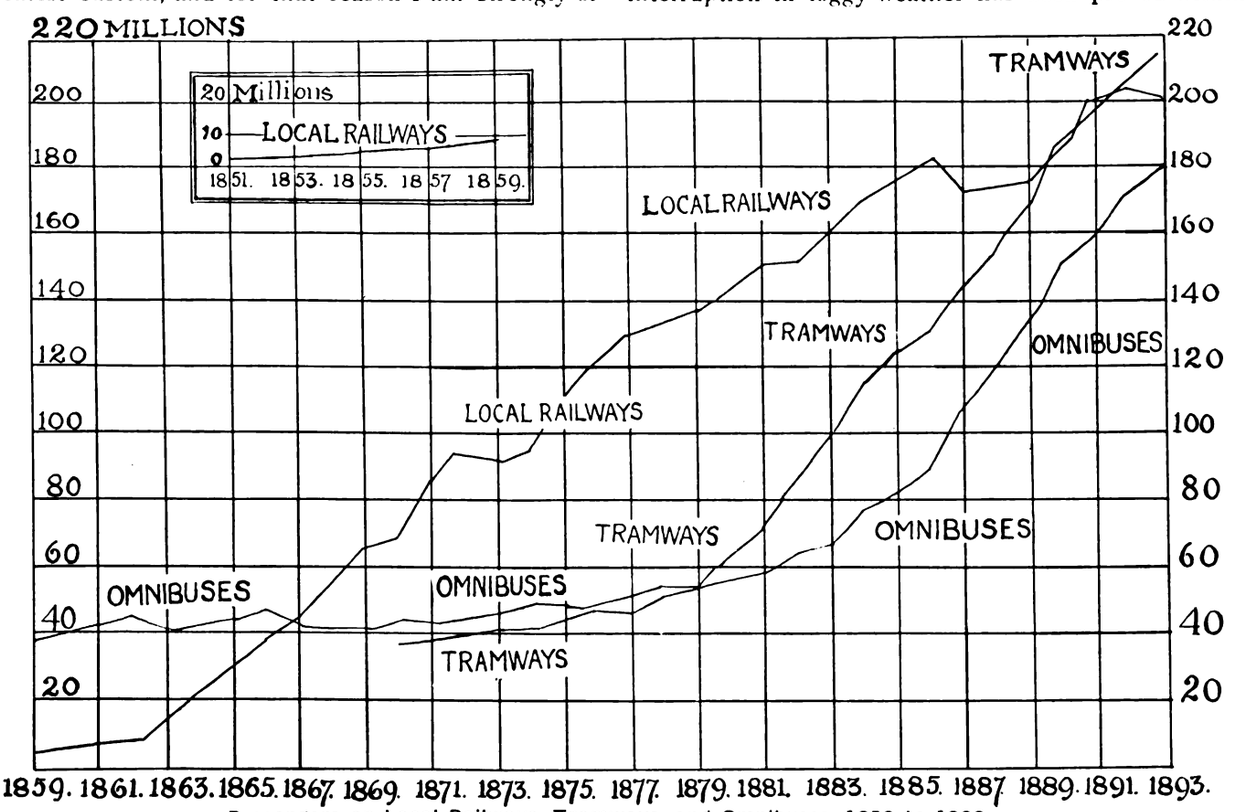
Notwithstanding the decrease of population at the centre, the number employed in various occupations in the city and other business areas is increasing year by year, as is shown partly by the enumeration of the city's day population given above, and as these people live further away from their work, the provision of adequate means of transport has become more pressing. Naturally, whichever system—train, tram, or 'bus—ensures the quickest transit will secure the greatest custom, and for that reason I am strongly of the belief that those main line railways which have termini in or near the City, which will give express services from suitable points, say six, eight, or ten miles out (according to the route of the railway), and which provide improved stations with enclosed waiting rooms (not merely shed-roofs over wind-swept platforms) should attract all through traffic from such points and beyond, and abandon the inner and short intermediate-distance traffic to the trams and omnibuses, which would then become feeders to the railways. Railway carriages should, moreover, be as clean and well lighted as other vehicles. Dirt and darkness have lost as many passengers from the older railways as slowness and unpunctuality, and while strict adherence to a time table is impossible on tramways or omnibuses, by train it should be as reliable as time keeping by Big Ben—an occasional slip is inevitable.

Through Communication.

Through communication on railways has been neglected, but the improvement in traffic on the District Railway by the running of east and west-bound trains over the Whitechapel and Bow line, which connects it with the London, Tilbury, and Southend Railway, should serve as an object lesson. On this short inter-connecting link, which is only two miles long, the traffic density in 1911 was 12,165,000 passengers per route-mile, compared with a little over 3,000,000 per route-mile on the District system as a whole.

Tube Railways.

The tube railways have not come up to the expectations of their promoters in any case, and, taken altogether, they are still over 80 millions short of the number of passengers required to pay dividends on their statutory capital. Yet nothing in the way of transit facilities which has been introduced into London in recent years better deserves reward, for it is owing to their introduction that other improvements in methods of transport are due. Their freedom from interruption in foggy weather has been proved within the last few weeks—a freedom unknown on any surface railway or tramway or road conveyance—and their carriages are models of comfort and their lighting excellent. But the noise is very great when the trains are in motion, making conversation on some lines impossible. For short distance runs too, the time taken in descending and ascending by the lifts, not to mention the rather long underground walks to and from the trains, makes the time occupied between stations almost as long as by omnibuses on parallel routes, so that many people prefer the open-air ride, there being a natural prejudice in favour of remaining above ground as long as possible, especially with people who are not quite certain as to their destination. But where the tube railway leads direct to such points as Piccadilly, and Regent Street and Oxford Circus, as from Waterloo, and the 'bus route is devious and uninviting, as in this case, the tube obtains the preference, as is proved by the "Bakerloo," a non-competitive railway carrying 7,500,000 passengers per route-mile, a total of 30,000,000 in 1911, or within 5½ millions of



Passengers on Local Railways, Tramways, and Omnibuses, 1859 to 1893.

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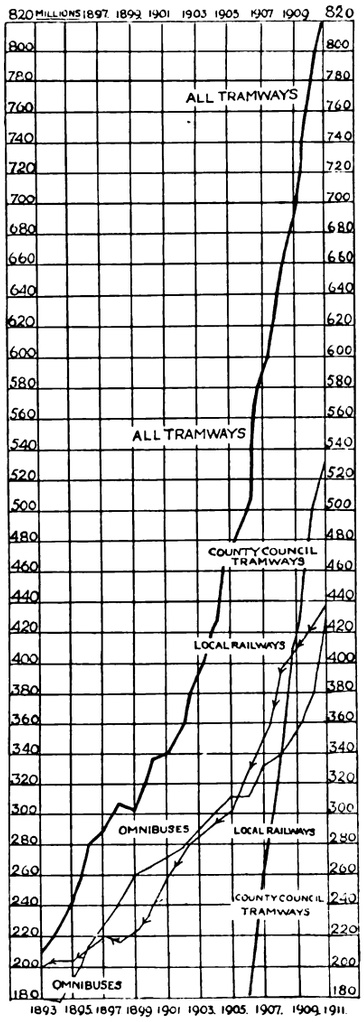
the number necessary to put it on a dividend paying basis, which it will probably obtain on the completion of its extension to Paddington.

Omnibuses.

These were first introduced into London by Mr. Shillibeer in 1829, when he established a service of horse-drawn vehicles between Paddington and the Bank. This was also the year in which the General Post Office at St. Martin's-le-Grand—recently demolished—was opened. Each vehicle accommodated from 16 to 20 passengers.

Prior to 1829 such vehicular traffic as existed between various points in London and outside districts was by stage coaches licensed to ply between the City and points about 20 miles out, of which there were some 600, which carried over 65,000 passengers inwards and outwards daily.



Passengers on Local Railways, Tramways and Omnibuses, 1893 to 1911.

London at that time was a city of less than 1,600,000 inhabitants, a resident settled population, of whom nearly one-twelfth dwelt within the one square mile known as "The City." Westwards, along the route of the Paddington omnibuses, Holborn contained about 90,000 people, St. Pancras about 100,000, and St. Marylebone about 120,000. Paddington had only some 14,000 people then, and the Bayswater district was under grass. Notwithstanding the pretty stiff fare of 6d. per passenger for any length of ride between the two termini, the business seems to have been a remunerative one from the start, for the omnibuses were never afterwards withdrawn, though submitted for a time from April 22, 1833, to the competition of London's first steam omnibus "The Enterprise," which, however, was shortly withdrawn as a mechanical and financial failure, nothwithstanding its capability of maintaining a speed, under favourable conditions, of from 8 to 10 miles per hour. Another of these steam omnibuses was run from Stratford to Islington, and must have been the vehicle to which the late Sir Frederick Bramwell referred in conversation with the writer in 1895, when he stated that on the opening of Moorgate Street the first wheeled conveyance to pass through was a steam omnibus, which, being present, he had seen, as also its being put into shelter in premises in City Road. I have since ascertained that the offices of the owning company were situated at 68, Charles Street, City Road, and that the date of introduction was as above given.

It was not until 1910 that steam omnibuses again appeared on the London streets; but the horse-drawn omnibus, with its limited passenger capacity, remained and prospered, for some nine years later, according to Sir Laurence Gomme,* there were 200 of them in service on the following routes in 1837:

Between the Angel, Islington, and the Elephant and Castle, Newington Causeway	17
Between Elephant and Castle and Charing Cross.. ..	3
West End and Bank along the New Road (now Marylebone Road)	54
Charing Cross to Blackheath	14
Piccadilly to Blackwall	41
Chelsea to Leadenhall Street..	27
Charing Cross to Hampstead	19
Bank to Paddington Road	25

It will be observed that the routes were comparatively short, and that the City was the turning point for more than half the total number. This remained the case even as new routes were opened up, and the number of omnibuses increased until at the end of 1901 the total had reached 3,736 vehicles. All by that time were fitted with staircases and garden seats on top, introduced in 1882 by the London Road Car Company. The London General Omnibus Company, though formed in 1855, was content to perpetuate till then the old knife-board type of top seat, to which access was obtained by a vertical ladder attached to the rear end of the body of the omnibus, and with four passenger seats beside the driver, reached by stepping up over the front wheels.

The chart and table show the changes wrought by the introduction of the motor omnibus, which for the first few years after its appearance had a hard struggle to make headway owing to underpowering and excessively heavy construction; but the motor omnibus will in the course of the next few months have wholly supplanted the horse-drawn vehicles.

Local London Railways.

The first of these were the London and Greenwich and London and Blackwall Railways, opened for traffic in 1836, the first now merged in the South Eastern Railway and the second in the Great Eastern Railway.

The first local railway still retaining its individuality was the North London line, originally called the East and West India Docks and Birmingham Junction Railway, which has been in use as a steam railway till the present time, but is soon to be electrified, its control having been taken over by the London and North Western Railway. In order of age, the local London railways are as follows:

Steam	North London Railway	1851
	North and South West Junction Railway	1854
	Metropolitan Railway ..	August 11, 1863, El. 1905-6
	Metropolitan District ..	December 24, 1868, El. 1905-6
	East London Railway ..	1870, El. to be completed April 1
	Metropolitan and District Joint Lines,	Oct. 1, 1884, El. 1905-6
Electric	City and South London	December 21, 1890
	Waterloo and City	August 8, 1898
	Central London	July 30, 1900
Steam	Whitechapel and Bow	June 1, 1902, El. 1905-6
Electric	Great Northern and City	February 14, 1904
	Baker Street and Waterloo	March 10, 1906
	Great Northern, Piccadilly, and Brompton,	December 15, 1906
	Charing Cross, Euston, and Hampstead, ..	June 22, 1907

The chart shows the traffic of these railways during the past 20 years, and the effect of opening the newer lines upon the older railways, while the tables give the totals of passengers carried annually by the various local lines since 1891, allowing 600 journeys per annum to each annual ticket.

* "London in the Reign of Queen Victoria." A. and C. Black.

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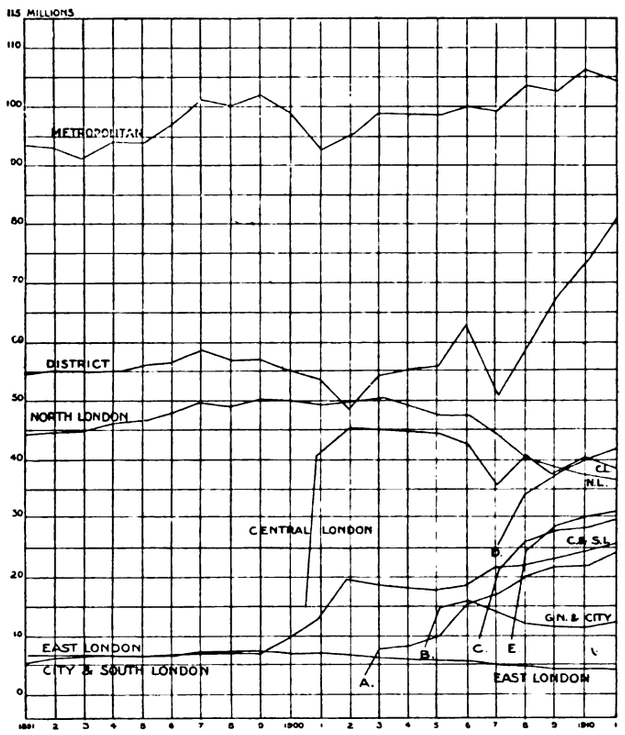
Main Line Railways with London Termini.

Underneath are given the main lines with London termini divided into two categories, those with the heaviest London suburban traffic and those with the lightest, the total number of passengers carried by each, on the basis of 600 journeys per annual ticket added to the ordinary tickets issued in the year 1911, against each being set the percentage of the suburban traffic to the total traffic of the line.

I.		
Great Northern Railway	66,834,016	50 per cent.
Great Eastern Railway	133,798 843	80 ,,
South Eastern and Chatham	83,631,021	75 ,,
London, Brighton, and South Coast	77,888,433	75 ,,
London and South Western	82,632,617	33
London, Tilbury, and Southend	41,401,038	80
II.		
Great Western Railway	130,424,421	10 ,,
London and North Western Rly.	113,340,661	10 ,,
Midland Railway	81,293,217	10 ,,
Great Central Railway	43,744,660	8 ,,

The approximate grand total of suburban traffic for all these lines for 1911 was 359,891,976.

Passengers Carried on Local London Railways from 1901 to 1911 (including Season Ticket Holders).



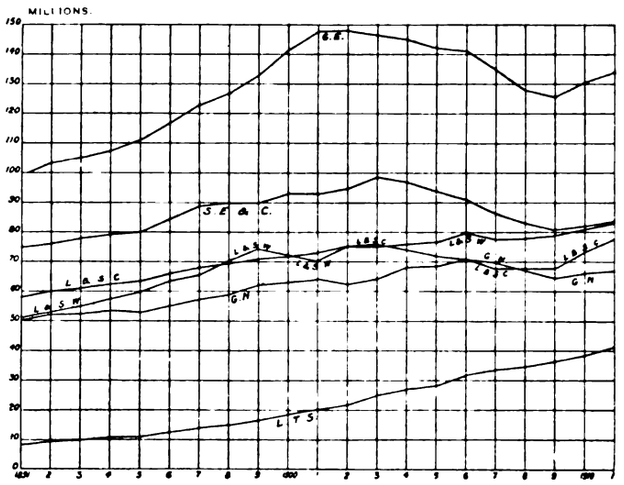
A, Whitechapel and Bow; B, Great Northern and City; C, Baker Street and Waterloo; D, Great Northern, Piccadilly, and Brompton; E, Charing Cross, Euston and Hampstead.

Charts showing the total traffics of these railways for the past 20 years are appended, from which the effects of tramway and motor omnibus competition on such lines as the Great Eastern, South Eastern and Chatham, and the London-Brighton Railways are clearly discernible.

London Cab Service.

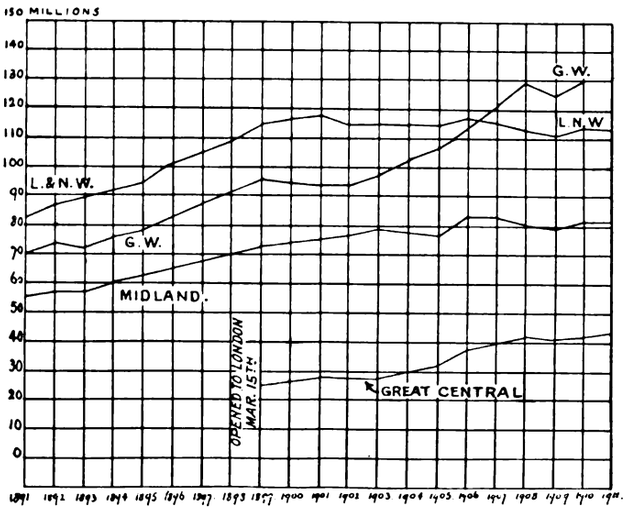
The table gives particulars of the number of motor and horse cabs licensed in London in each of the past 12 years. That the number is far in excess of the requirements has been clearly demonstrated by the cab strike of the past winter, showing that the removal of several thousand cabs from the streets has caused but slight inconvenience. Nor could it be otherwise, seeing that the total number of cabs at the end of 1912 was quite as great as when horse cabs exclusively were in use, whereas by doubling the speed the motor cabs can deal with twice the number of passengers which the horse cabs could cope with. This also leaves out of account that the high-speed motor omnibuses have made very serious inroads into the cab traffic. The cab business, notwithstanding its having provided

Passengers on Main Line Railways with London Termini and Heavy Suburban Traffic, 1891 to 1911.



riding accommodation for about 65,394,480 people in 1911, has been very clearly overdone, as the average earnings per cab prove.

Passengers on Main Line Railways with London Termini and Limited Suburban Traffic, 1891 to 1911.



Tramways.

Tramways were first introduced into London by George Francis Train in 1860, when two short lengths of line with raised rails were laid down—one in Victoria Street, Westminster, and the other in the Edgware Road at the Marble Arch end. The inconvenience of raised rails was quickly demonstrated, and the lines were shortly afterwards pulled up. But the idea had "caught on," and the production of the grooved rail made the construction of street tramways possible, and in 1870 the following lines were opened for traffic.

Metropolitan Street Tramways.—Westminster Bridge to Brixton and Clapham, *via* Westminster Bridge Road, Kennington Road, Kennington Park, Brixton Road, to West Brixton and Clapham Road to Clapham Common.

Pimlico, Peckham, and Greenwich Tramways.—New Cross to Greenwich by New Cross Road, Greenwich Road, and Trafalgar Road.

North Metropolitan Tramways.—Aldgate to Stratford,

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LOCAL LONDON RAILWAYS in Operation December 31, 1912.	Double Track.	Single Track.	Total Route Miles.	Equivalent Single Track including sidings.
East London	6	1	7	13
Central London	6	1	7	21
City and South London	8	—	8	18
Baker St. and Waterloo	4	—	4	10
Charing Cross, Euston, and Hampstead ..	8	—	8	20
Great Northern and City	3	—	3	7
Great Northern, Piccadilly, and Brompton ..	9	1	10	22
Metropolitan	43	5	48	132
Metropolitan District ..	25	1	26	65
Metropolitan & District Joint Lines	2	—	2	5
Whitechapel and Bow ..	2	—	2	5
North & South West Jct.	4	1	5	16
North London	14	—	14	69
Waterloo and City .	2	—	2	4

TRAMWAYS.

Owner.	Route Miles worked.	Cars in stock.	Passengers carried.
London County Council ..	141·23	1,680	533,440,235
London United Electric Tramways Co.	55·34	349	62,547,128
Croydon Corporation ..	11·92	75	20,849,230
SouthMetropolitanTry.Co.	13·26	51	7,478,568
Bexley U.D. Council ..	5·10	16	2,130,189
Dartford U.D. Council ..	6·55	12	1,774,451
Erith U.D. Council ..	4·71	17	2,749,889
Barking U.D. Council ..	2·84	9	3,193,409
East Ham Corporation ..	7·60	45	17,789,734
Ilford U.D. Council ..	6·66	26	7,784,992
Leyton U.D. Council ..	8·95	60	16,897,512
West Ham Corporation ..	15·56	118	41,017,938
WalthamstowU D.Council	9·14	38	12,049,323
Metropolitan Electric Tramways Co.	57·80	292	89,908,677
Totals	346·66	2,788	819,611,275

TRAMWAY CARS.

Year.	Horse-drawn.	Electric.	Total.
1900	1,458	0	1,458
1901	1,457	35	1,492
1902	1,342	316	1,658
1903	1,143	576	1,719
1904	928	810	1,738
1905	786	1,124	1,910
1906	605	1,396	2,001
1907	404	1,768	2,172
1908	323	2,003	2,326
1909	239	2,198	2,437
1910	129	2,411	2,540
1911	106	2,616*	2,722
1912(to Sep. 30)	59	2,736	2,795

* B.T. figures

OMNIBUSES.

Year.	Horse.	Motor.	Total.
1899	3,621	5	3,626
1900	3,681	4	3,685
1901	3,736	10	3,746
1902	3,667	29	3,696
1903	3,623	13	3,636
1904	3,551	31	3,582
1905	3,484	241	3,725
1906	2,964	783	3,747
1907	2,557	1,205	3,762
1908	2,155	1,133	3,288
1909	1,771	1,180	2,951
1910	1,103	1,200	2,303
1911	786	1,962	2,748
1912(to Sep. 30)	498	2,529	3,027
		2,598*	

* October 31, of which 2,240 were owned by the L.G.O. Co.

CABS.

Year.	Horse.	Motor.	Total.
1899	11,193	—	11,193
1900	11,254	—	11,254
1901	11,173	—	11,173
1902	11,382	—	11,382
1903	11,404	1	11,405
1904	11,057	2	11,059
1905	10,931	19	10,950
1906	10,492	96	10,588
1907	9,818	723	10,541
1908	8,475	2,805	11,280
1909	6,562	3,956	10,518
1910	4,724	6,397	11,121
1911	3,347	7,626	10,973
1912(Sep. 30)	2,589	7,859	10,448

PASSENGER TRAFFIC OF GREATER LONDON FROM 1851 TO 1911.

Year.	Population.	Omnibus.	Tramway.	Railway (Local).	Total (Local).	Journeys per head.
1851	2,680,935	No data available.		2,489,180		
1852	2,730,700			2,771,551		
1853	2,781,393	,,		3,230,614		
1854	2,833,031	,,		3,958,787		
1855	2,885,741	,,		4,939,964		
1856	2,939,232	,,		5,881,649		
1857	2,993,721	,,		6,056,789		
1858	3,049,126	,,		6,281,916		
1859	3,105,758	38,899,247		6,670,159	45,569,406	14·6
1860	3,163,846	40,123,366		6,856,492	46,979,858	14·8
1861	3,222,720	41,369,893		7,103,608	48,464,501	15·0
1862	3,283,951	42,768,248		7,808,181	50,576,429	15·4
1863	3,346,346	40,201,838		11,838,751	52,040,589	15·6
1864	3,409,927	42,648,936		20,735,612	63,384,548	18·6
1865	3,473,315	44,006,581		26,116,853	70,123,434	20·2
1866	3,538,634	44,352,288		37,609,916	81,962,204	23·2
1867	3,605,510	41,424,428		43,147,355	84,571,783	24·1
1868	3,673,591	40,968,187	Tramways Started.	53,102,764	94,070,951	25·6
1869	3,742,956	41,047,521		64,284,961	105,332,482	28·1
1870	3,813,632	42,935,471	38,119,086	66,349,108	147,403,665	38·6
1871	3,885,641	43,556,545	39,475,254	83,625,498	166,657,297	43·0
1872	3,965,864	44,523,361	40,143,840	94,542,498	179,209,699	45·2
1873	4,047,745	46,066,247	40,512,104	93,604,119	180,182,470	44·5
1874	4,131,315	48,538,896	41,658,303	96,368,439	186,565,638	45·2
1875	4,216,611	47,920,038	46,049,435	110,193,945	204,163,418	48·4
1876	4,303,668	51,157,946	48,983,211	120,331,960	220,473,117	51·2
1877	4,392,521	52,853,630	48,451,713	127,204,179	228,509,522	52·0
1878	4,483,210	56,039,295	53,387,498	130,632,333	240,059,126	53·6
1879	4,575,771	55,531,827	56,041,767	136,542,164	248,115,758	54·2
1880	4,670,243	57,722,231	64,567,331	143,257,730	265,547,292	56·7
1881	4,766,661	58,389,907	72,038,962	149,603,233	280,032,192	58·7
1882	4,847,001	64,251,230	86,600,382	151,046,977	301,898,589	62·3
1883	4,928,695	67,888,416	98,499,709	161,703,306	328,091,431	66·6
1884	5,011,765	78,178,516	114,874,804	166,234,912	359,288,232	71·7
1885	5,096,235	83,883,168	125,900,107	175,256,830	385,040,105	75·6
1886	5,182,130	90,708,966	132,529,504	181,131,642	404,370,112	78·0
1887	5,269,472	108,323,639	145,902,087	172,873,415	427,099,141	81·1
1888	5,358,286	118,073,103	154,922,236	176,152,530	449,147,869	83·8
1889	5,448,599	133,722,139	171,167,740	177,833,443	482,723,322	88·6
1890	5,540,430	149,431,099	188,805,119	186,154,352	524,390,570	94·7
1891	5,633,806	158,926,241	198,569,584	200,390,281	557,886,106	99·0
1892	5,726,997	172,623,669	205,274,096	202,420,130	580,317,895	101·3
1893	5,822,613	179,504,329	213,315,588	200,706,024	593,525,941	101·9
1894	5,920,732	177,742,122	224,643,131	205,241,530	607,626,783	102·6
1895	6,021,433	192,077,010	240,760,225	206,271,572	639,108,807	106·1
1896	6,124,812	212,628,471	279,518,865	211,988,534	704,135,870	115·0
1897	6,210,779	227,205,048	294,615,474	219,911,452	741,731,974	119·4
1898	6,299,321	245,684,035	308,730,408	217,581,022	771,995,465	122·5
1899	6,390,534	261,019,076	303,002,749	223,842,604	787,864,429	123·3
1900	6,484,516	264,503,868	337,058,096	237,268,375	828,830,339	127·8
1901	6,581,402	269,933,759	340,772,414	260,091,297	870,797,470	132·3
1902	6,705,770	279,466,557	361,170,652	276,827,921	917,465,130	136·8
1903	6,710,272	287,386,471	394,356,531	285,340,248	967,083,250	144·1
1904	6,775,645	288,965,214	431,813,839	293,979,818	1,014,758,871	149·8
1905	6,841,651	290,665,051	477,944,684	301,871,304	1,070,481,039	156·5
1906	6,908,298	291,563,048	508,700,269	327,573,244	1,127,836,561	163·3
1907	6,975,593	*330,000,000	588,050,081	351,575,102	1,269,625,183	182·0
1908	7,043,540	*340,000,000	638,267,875	393,475,624	1,371,743,499	194·8
1909	7,112,145	*356,000,000	687,697,681	407,791,135	1,451,488,816	204·1
1910	7,181,415	†377,207,555	765,904,899	422,021,303	1,565,133,757	218·0
1911	7,252,963	*427,500,000	819,611,275	436,488,785	1,683,600,060	232·1

* Estimated: No returns being available.
† Given in 1911 Report of the London Traffic Commission.

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via Whitechapel Road, Mile End Road, Bow Road, and High Street.

These lines carried in their first year of working 38,119,086 passengers.

The lines authorised at that time, but not then completed for traffic, were:

Metropolitan Street Tramways.—Tulse Hill (Effra Road).

Pimlico, Peckham, and Greenwich Tramways.—Greenwich to Charlton: Blackfriars Road, Westminster Bridge Road (from Kennington Road to London Road), St. George's Road, London Road, Newington Causeway, New Kent Road, Old Kent Road, Walworth Road, Camberwell Road, Peckham Road, High Street, and Queen's Road to New Cross; Camberwell New Road, Kennington Oval (both sides), Harleyford Road, Vauxhall Bridge, Vauxhall Bridge Road, Victoria Street (to Strutton Ground), Strutton Ground, Horseferry Road, and Lambeth Bridge.

North Metropolitan Tramways.—Extensions from Stratford along Romford Road into West Ham. From Finsbury Pavement along City Road, Liverpool Road, High Street, Islington, and Holloway Road to the foot of Highgate Hill.

London Street Tramways.—Hampstead Road from Euston Road to and along Camden Park Road and Seven Sisters Road. From King's Cross along St. Pancras Road, Great College Street, and Kentish Town Road to the railway station.

The lines along Victoria Street, Strutton Ground, Horseferry Road, and over Lambeth Bridge were never laid down; and the tramways along Vauxhall Bridge Road remained isolated owing to the inadequacy of old Vauxhall Bridge, until after the construction of the new bridge and electrification of the tramways by the London County Council.

The successful working and utility of the tramways having been proved by abundant patronage, apart from financial success, the usual speculation in tramway promotion set in, and the support of the City authorities and the Metropolitan Board of Work was readily forthcoming even for the enmeshing of all the principal streets and bridges, including Holborn, with lines extending from Newgate Street over the recently constructed Holborn Viaduct, and a loop round the Smithfield Market by Charterhouse Street to Holborn, and along Oxford Street, Bayswater Road, and Uxbridge Road to Southall in the west; through St. Paul's Churchyard by the north end of St. Paul's Cathedral, Cannon Street, Queen Victoria Street, King William Street, over London Bridge and Southwark, Blackfriars, Waterloo, Westminster, Lambeth, and Vauxhall Bridges; not to mention a bill for a line from Hammersmith, through Knightsbridge, Piccadilly, the Haymarket, Pall Mall East, Charing Cross, and Whitehall, and Victoria Embankment to Westminster Bridge.

Fortunately for London, few of the promotions of 1871 obtained Parliamentary sanction, among which those above mentioned were not included, except the one line from Shepherds Bush *via* Acton and Ealing to Southall, which now forms part of the London United Electric Tramways system.

Steam Traction.—Experiments with steam traction were made in 1873 and 1876, but this system, which was adopted in the Potteries in 1876, fortunately did not obtain approval in London.

The North Metropolitan Tramways Company ran a few cars fitted up on the Elieson system with accumulators in East Ham, where they were introduced in 1887, but discontinued in 1892.

Cable Traction.—In 1884, the Highgate Hill cable tramways were opened for traffic, and subsequently the same system was adopted on Streatham Hill in 1892.

LONDON TRAFFIC—TRAMWAY PASSENGERS IN GREATER LONDON.

Year.	Walthamstow U.D.C. Tramways.	Leyton U.D.C. Tramways.	West Ham Corporation Tramways.	East Ham Corporation Tramways.	Ilford U.D.C. Tramways.	Barking Town U.D.C. Tramways.	Erith U.D.C. Tramways.	Dartford U.D.C. Tramways.	Bexley U.D.C. Tramways.	Croydon Corporation Tramways.	South Metropolitan Tramways.	London United Electric.	Metropolitan Electric Tramways.	London County Council Tramways. Horse Traction.	Electric Traction.	Total.	Total of all Tramways in Greater London.
														Old Companies' lines partly taken over from Companies 1st January		117,992,713	
1899	...	...	...	...	...	...	...	...	...	...	...	...	...	117,992,713	...	117,992,713	303,002,749
1900	...	...	...	...	...	...	...	...	...	...	...	...	...	118,281,320	...	118,281,320	337,058,096
1901	...	...	...	22nd June 5,298,476	...	...	...	...	...	**26th Sept. (a) 3,041,788	...	3rd April No return	...	119,880,559	...	119,880,559	340,772,414
1902	...	...	...	9,971,337	...	...	...	...	...	11,523,357	...	(c) 36,209,737	26th Nov. 1,280,009	109,615,496	...	109,615,496	361,170,652
1903	...	...	27th Feb 385,892	12,950,269	14th March 5,056,461	*1st Dec. 251,598 (605,532)	...	...	3rd October 548,079	13,641,153	...	45,293,473	13,924,105	79,787,245	11th May 53,351,840	133,139,085	394,356,531
1904	...	...	15,773,592	13,689,658	5,584,901	605,532	...	...	1,527,982	14,314,029	...	48,126,727	El. 20th July 17,631,157	38,563,280	126,255,280	164,818,560	431,813,839
1905	3rd June 5,743,010	...	23,364,077	14,444,290	6,271,173	625,065	26th Aug. 1,508,644	...	1,677,637	14,732,446	...	49,157,139	28,842,989	41,666,866	141,845,555	183,512,421	477,944,684
1906	8,729,521	1st Decr. 3,517,590	35,502,836	15,049,240	6,586,754	522,444	2,494,915	14th Feb. No return (14 months.) 2,055,033	1,737,204	16,078,629 (b) 13,514,918	June 3,354,731	55,355,281	36,318,774	†131,165,027	183,062,063	314,227,090	508,700,269
1907	9,756,904	12,323,476	34,712,220	15,355,703	6,385,466	946,890	2,288,491	1,540,635	16,277,418	6,923,707	58,725,980	48,242,404	93,349,293	279,166,461	372,515,754	588,050,081
1908	9,904,037	12,259,464	33,773,713	16,071,857	6,586,163	1,280,420	2,205,762	1,752,641	1,717,182	16,266,475	6,911,094	59,255,919	57,369,307	68,207,904	344,705,937	412,913,841	638,267,875
1909	10,640,494	14,260,980	36,846,649	16,059,912	7,274,398	1,292,146	2,324,717	1,685,155	2,166,494	18,705,604	6,893,162	55,750,807	62,357,947	38,121,839	418,317,377	451,439,216	687,697,681
1910	11,316,684	15,689,069	37,297,992	17,668,911	7,657,401	1,903,892	2,622,908	1,781,046	2,199,180	19,476,576	6,982,483	60,132,451	76,460,980	22,418,391	482,296,935	504,715,326	765,904,899
1911	12,049,323	16,897,512	41,017,938	17,789,734	7,784,992	3,193,409	2,749,889	1,774,451	2,130,189	20,849,230	7,478,568	62,547,128	89,908,677	17,347,746	516,092,489	533,440,235	819,611,275

* Number carried between 1st December and 31st March. ** Worked by British Electric Traction Company as Lessees of the Corporation of Croydon till 31st May, 1906. Lines within borough afterwards by Corporation; outside lines by Company. † North London Tramways taken over. (a) Electric tramways and horse lines also included. (b) Total of Corporation and Company lines for year ended 31st December. (c) Taken over from old West London Company in 1902.

The grand totals include passengers by the old companies' horse-drawn cars, which are not given separately, as the companies ceased to exist on transfer of their lines to the County Council, to other local authorities, and to the London United Electric and Metropolitan Electric Tramway Companies.

NOTE.—In the above the Company returns are to 31st December in each year; Corporation returns to 31st March in the following year.

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Electric Traction.—On January 1, 1899, some of these tramways were taken over by the London County Council, who had decided to acquire the whole of the tramways within the county, and to convert them from horse traction to electric traction, which is still being leisurely carried out. The table dealing with the number of passengers carried on the tramways in Greater London shows with what lack of diligence the County Council has pursued the policy of electrification.

The total length of the old tramways in Greater London taken over by the County Council was 107 route-miles in running order, and the 2⅞ route-miles of the derelict lines of the Camberwell and Dulwich Tramways, which have since been taken up.

A peculiarity to be noted is the varying density of traffic in the several districts, both as to number of passengers per route-mile and to the journeys per inhabitant in 1911—the last year for which there are complete returns. These are again best shown in tabular form, as below.

The greater use made of the tramways in the East and West Ham districts demonstrates the preference of the working classes for this type of vehicle, while the high percentage of travel in the Croydon district, a residential middle-class area, is said to be largely due to low fares, comparatively high speeds (recently considerably increased), and especially to the fact that the lines pass five railway stations and are not far distant from three others, railway and tram thus helping each other. Interurban traffic in three of the districts gives the lowest results, and it is evident that in the case of the London United electric system the cars in stock are far in excess of the ordinary traffic requirements, the large number of spares necessary for summer holiday traffic being a real incubus. The Metropolitan Electric Company with 57 fewer cars was able to carry nearly 27½ million more passengers in the course of the year.

Regarding existing tramways outside the county boundary, these were conveyed to other local authorities or to new companies, of which there are now three operating in Greater London. These are the London United Electric Tramways Company, the Metropolitan Electric Tramways Company, and the South Metropolitan Tramways Company. The first-named acquired and works the old West London Tramways Company's lines (of which the portion in Hammersmith within the County of London will soon be taken over by the County Council) and a number of new lines in outer districts which partake more of interurban than urban character, specially constructed for electrical working. These have proved to be anything but a gold mine for the shareholders. The Metropolitan Company operates electrically the lines which were taken over by it from the old North Metropolitan Company, and those of the Middlesex County Council and the Hertfordshire County Council, as well as 3·175 detached miles of the London County Council lines in the borough of Paddington, the total length of such owned and leased lines being 57·8 route-miles. The South Metropolitan Company works the lines outside Croydon, connecting Croydon with Sutton and with Mitcham and Penge.

The local authorities, other than the County Council, owning and working their own tramways are ten in number, and their names and the dates on which their lines and those of the three companies commenced to be electrically worked are as follows :

London United Electric Company ..	April 3, 1901.
East Ham Corporation	June 22, „
Croydon Corporation	September 26, „
West Ham Corporation	February 27, 1903.
Ilford Urban District Council	March 14, „
London County Council	May 11, „
Bexley Urban District Council	October 3, „
Barking Urban District Council	December 1, „
Metropolitan Electric Company	July 20, 1904.
Walthamstow Urban District Council ..	June 3, 1905.
Erith Urban District Council	August 26, „
Dartford Urban District Council ..	February 14, 1906.
South Metropolitan Company	June 1, „
Leyton Urban District Council	December 1, „

ELECTRIC TRAMWAYS OF GREATER LONDON.

	* Inhabitants in Districts served.	Tramway Route-Miles.	Cars in Stock.	‡ Total Passengers.	Traffic Density per Route-Mile.	† Journeys per Inhabitant.
COUNTY OF LONDON	4,060,767	141·23	1,584	533,440,235	3,772,000	124
EASTERN DISTRICT :						
(a) Barking, Ilford, East and West Ham	532,113	32·66	198	69,786,073	2,136,000	131
(b) Walthamstow and Leyton	289,347	18·14	98	28,946,835	1,600,000	106
SOUTH EASTERN DISTRICT :						
Erith, Dartford, and Bexley	67,305	16·56	45	6,654,529	415,000	98·6
SOUTHERN DISTRICT :						
Croydon Corporation and South Metropolitan Co.	224,025	25·18	126	28,327,798	1,130,000	126·5
WESTERN AND SOUTH WESTERN DISTRICT :						
London United Electric Tramways Company .	635,228	55·34	340	62,547,128	1,132,000	98·4
NORTHERN DISTRICT :						
Metropolitan Electric Tramways Company .	920,510	57·8	292	89,908,677	1,538,000	98
Totals..	6,729,295	346·71	2,683	819,611,275	1,675,143 (average)	111·8 (average)

* The populations of the Cities of London and Westminster and in the Boroughs of Kensington, Marylebone, Chelsea, and Hampstead are not included, as the tramways merely touch or skirt their boundaries at few points, and therefore give no through service. † Of population served by tramways. ‡ Includes about 18,000,000 passengers carried by horse cars.

Even after the commencement of electrical working a large proportion of the above lines continued to be worked by animal power pending reconstruction, and still at December 31, 1912, 8·45 route-miles owned by the London County Council remained to be converted, while the Richmond-Kew lines of the London United Company are being taken up.

On the County Council tramway lines the underground conduit, placed centrally between the running rails, with insulated supply and return conductors has been adopted generally, the overhead trolley system with rail return being used only on some suburban sections. Some cars owned by the Council and by outside authorities and the North Metropolitan Company are fitted with double circuit wiring for interchange running on both trolley and conduit lines.

AN EXAMPLE OF DEVELOPMENT.

The change in the habits of the people, as well as in the conditions of tramway traffic, which has taken place within the past 30 years is well illustrated in the case of the Croydon returns, which may serve as an example of what has happened in other districts.

In the first six months of 1885 the then horse tramways, dating from three or four years before, carried

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380,276 passengers, or 3·3 passengers per car-mile, the car-mileage on 10 miles 63 chains of road being 115,677, the gross receipts for the same period £6,056, the average fare 1·5d. per passenger, the population then being about 120,000, and the journeys per inhabitant a little over six a year.

In 1899, the last complete year of horse traction, Croydon had a population of 170,000 in round figures; the number of car-miles run on 10·63 miles of line were 401,809, and the number of passengers 3,512,558, or 8·74 persons per car-mile, representing 26 journeys per inhabitant, and the total income of £17,631 was equivalent to an average fare of 1·24d. for each passenger.

In 1911-12, with electric traction, the number of car-miles run on 11·92 route-miles of lines was 2,387,566, the number of passengers 20,849,230, or 8·78 per car-mile, equal to 98·3 journeys for each of the 212,000 people resident in the district, the gross receipts of £92,539 giving an average fare of 1·06d. for each person riding on these tramways.

This fare, moreover, is for a journey of more than two miles, the halfpenny fare being for one mile. Yet after payment of all charges and placing £9,304 to reserve for depreciation and renewals, there was a balance out of profits which enabled the Corporation to appropriate no less than £8,000 to the relief of the local rates.

The speed of the electric cars in Croydon is now 9·08 miles per hour, compared with about six miles per hour in the days of animal traction.

In regard to omnibus traffic the tables include only the London General Omnibus Company till 1884; since 1884 to 1906 both the London General Company and the London Road Car Company; the estimated figures since 1907 are for all omnibuses in Greater London, whether owned by companies or firms. In 1912 the London General Company carried 487,221,629 passengers, and probably 25,000,000 were carried by other omnibus companies in London.

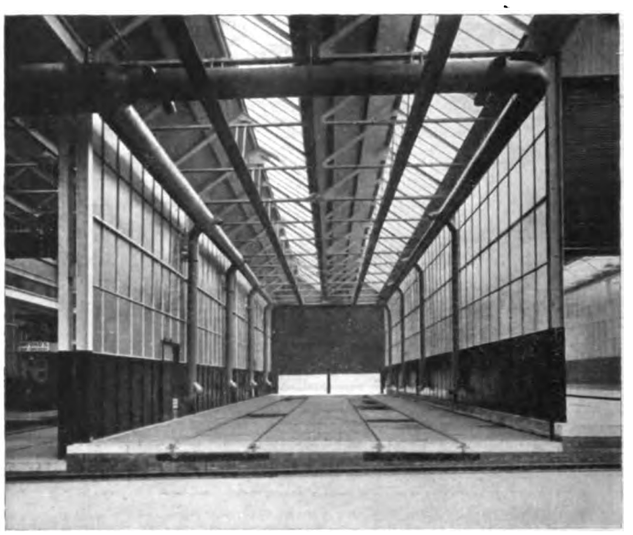
Future of Omnibus Competition.

The severity of the attack of the motor omnibus on the tramways is well nigh spent. By the time 3,000 of these vehicles are in use on the streets they will have so far reacted upon themselves as to reduce the number of passengers per 'bus-mile below the paying point. Besides that, heavier depreciation will set in with the increasing age of the vehicles. The advancing cost of petrol, which has already made such inroads into estimated profits, will still further adversely affect the cost of working, while the tramways, notwithstanding the unfair competition, still go on with a ratio of expenses to revenue of about 60 per cent. Their loss in passengers during the past year is less than 4 per cent. on the previous year's numbers. Should the various local authorities succeed in making good their claim to compensation for road repairs from abnormal traffic, the omnibus companies will be hard put to it to make both ends meet, despite their average fare of 1·329d. per passenger, against the tramways average of 1·03d., or less, at the present time. The ratepayers' money is invested in the London County Council tramways alone to the extent of over £12,000,000, or taking also the other local authorities in Greater London, to over £16,000,000.

Electric Underground Railways for Sydney.—The New South Wales Government on February 5 approved the project for the construction of electric underground railways in Sydney, the city section of which is to consist of three lines instead of two, as originally recommended. The scheme is to be carried out on account of the tramways have reached the limit of their capacity, although in the suburbs the cars attain speeds of 20 miles an hour.

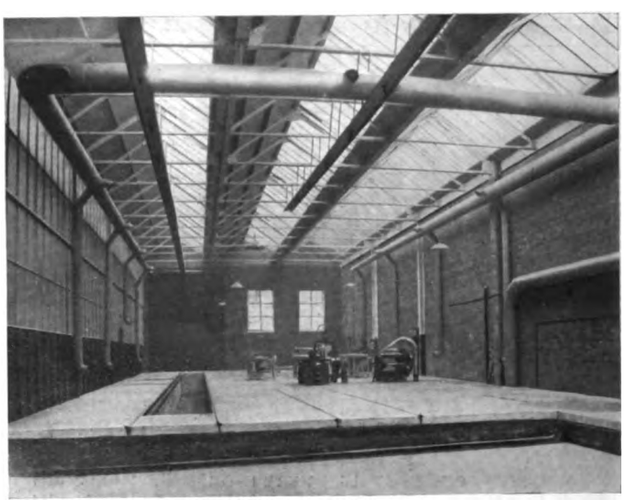
BOLTON TRAMWAYS NEW REPAIR SHOPS.

The new car repair depot of the Bolton Corporation, which has been under construction for some time, was formally opened on Wednesday, February 5, by Mr. John Miles, chairman of the Tramways Committee, in the presence of a large company of guests. The new works cover an area of about three-quarters of an



Electrical Repair Shop.

acre, and, as will be seen from the photographs and accompanying plan, they provide adequate and convenient shops for carrying out the whole of the repair work required. The need for such a central depot has of late years been much felt as the tramway undertaking has developed, and both the officials and employees of the department may be congratulated on the improved conditions under which the repair work will now be done.



Body Shop.

The new repair shops are bounded on three sides by streets, and the façades of the building are of a neat and suitable character. The walls of the building are of brick with stone dressings. Over the main shops the roofs are of steel on the Warren girder principle, and are carried on steel stanchions; those over the stores and club rooms are the usual type of steel trusses, all being covered with Welsh slates. The floors are mainly on concrete, wood blocks being used in the armature rooms, offices, and main passages. The

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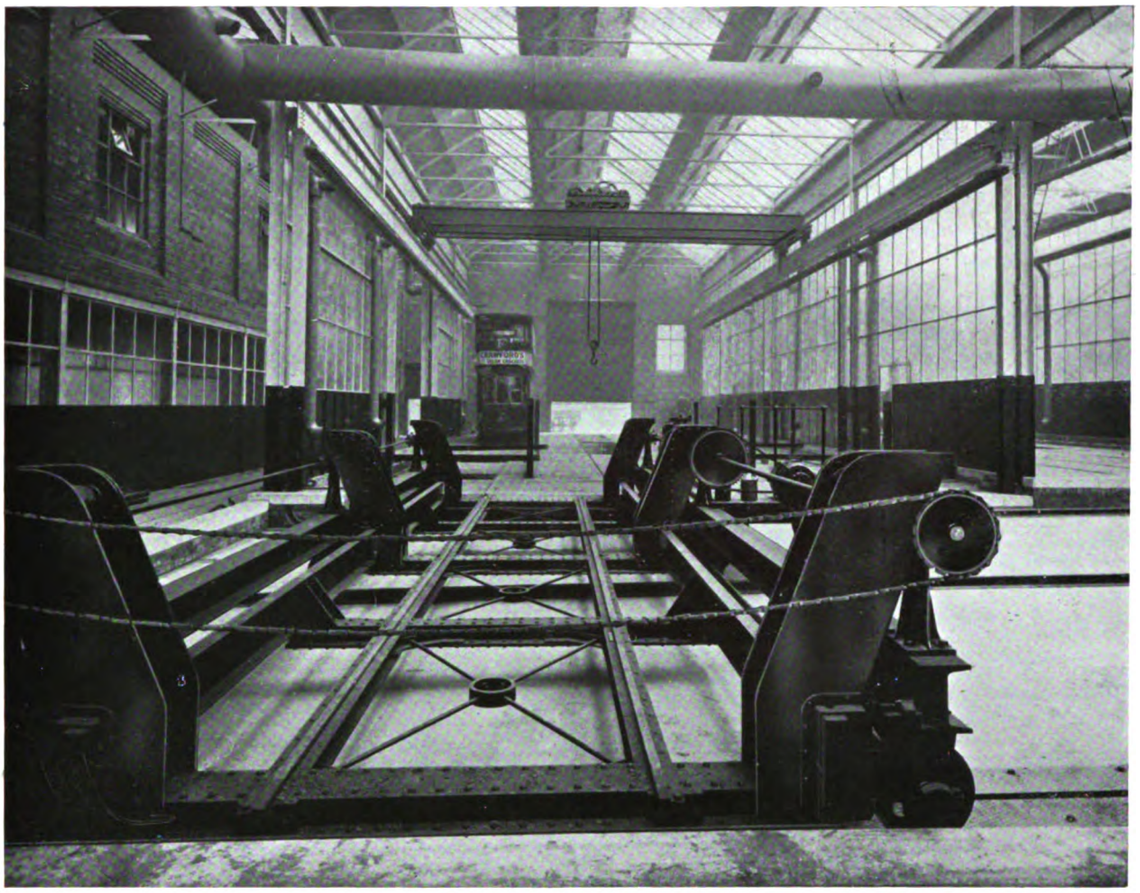
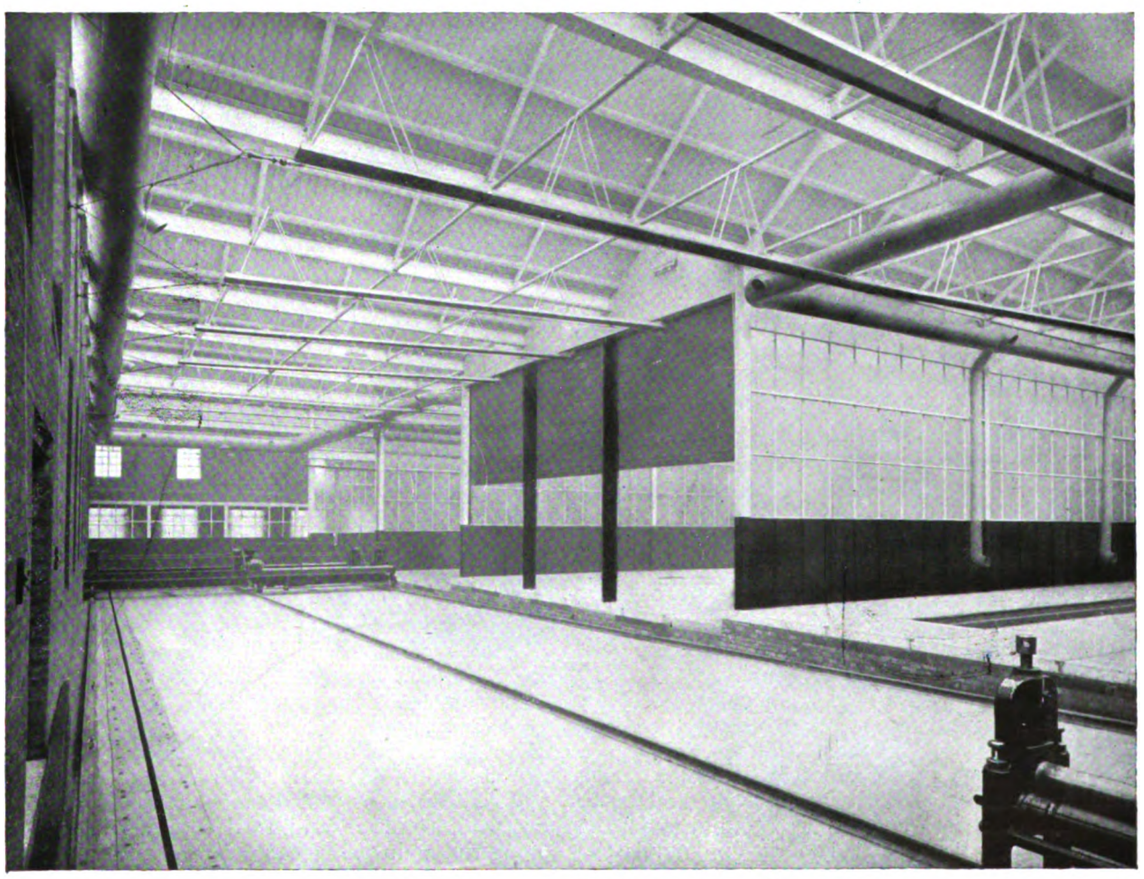


Bolton Tramways Traverser and the Wheel and Truck Shop.



Traverser Run—Bolton Tramways Repair Shop.

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main shops are divided by steel and glass partitions, and the doors and large openings are fitted with revolving shutters.

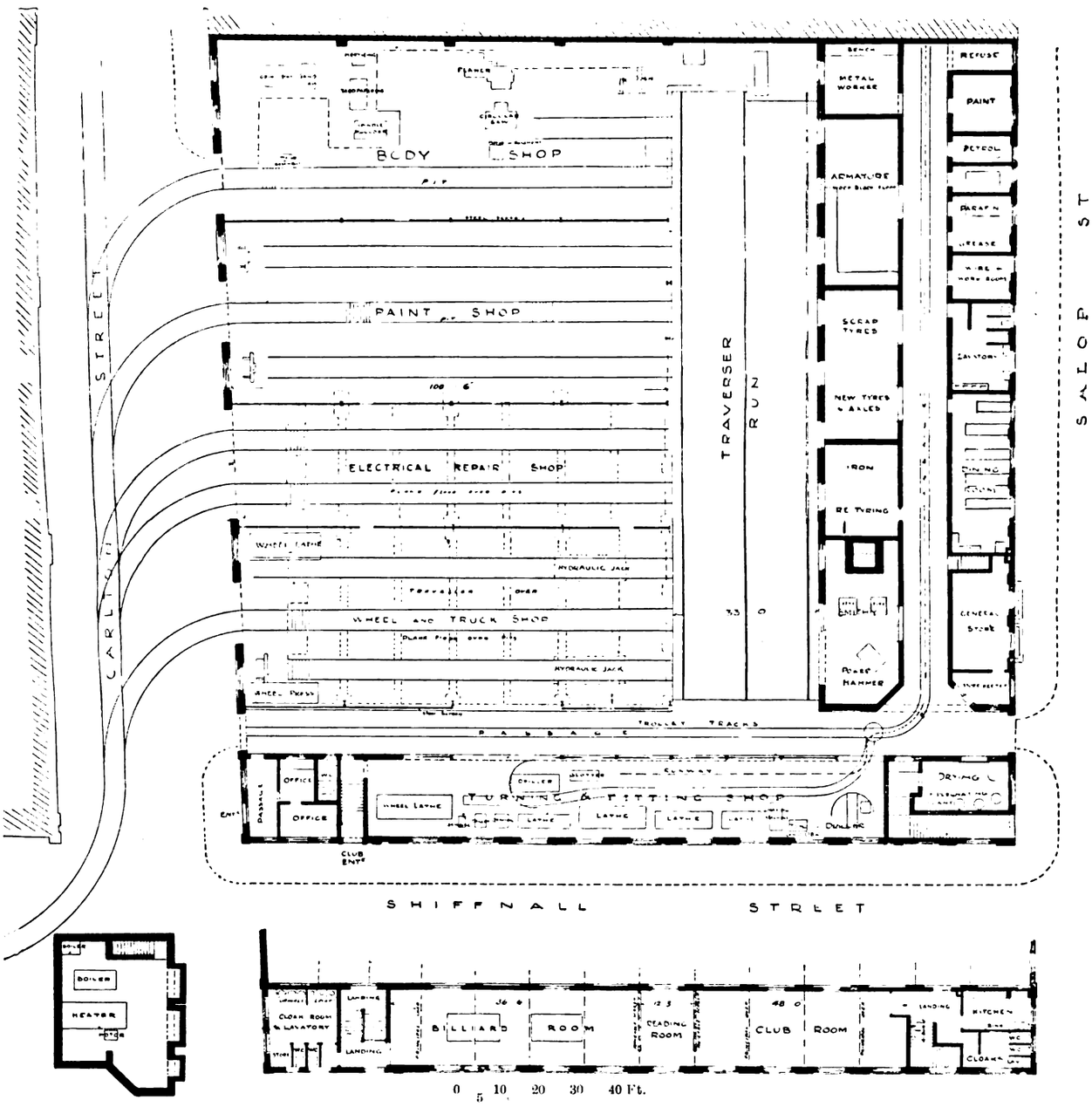
The building comprises the following departments: Wheel and truck shop (98 ft. long by 41 ft. wide), electrical repair shop (100 ft. long by 28 ft. 6 in. wide), paint shop (102 ft. long by 41 ft. 6 in. wide), body shop (103 ft. long by 41 ft. wide), turning and fitting shop (117 ft. long by 18 ft. wide), smithy (38 ft. by 16 ft.). There are also shops for metal working, armature repairing, re-tyring, drying, and various stores, club rooms, and offices as shown on the plan.

The works are fitted with modern machine tools. In the wheel and truck shop is an overhead travelling crane capable of lifting 7½ tons. There are also a wheel lathe, a wheel press, and two hydraulic jacks, each built to lift a car. Both in the wheel and truck shop and the electrical shop there are pits over the whole area, the rails being carried on brick pillars. In the body shop there are a circular saw, hand and power feed planer, mortising and sandpapering machines, a single and upright moulder, band saw, grindstone, etc. A basement in this department provides space for placing of motors and shafting for driving the machinery, which is done throughout the works by electric power. In this basement are collected the suction pipes to the pneumatic dust removing installation, which is fitted to this shop and discharges the rubbish into the boiler house.

The turning and fitting shop is provided with five lathes, two radial drilling, tool grinding, shaping, slotting, grooving, and drilling machines, grindstone, etc. In this department is an overhead runway and trolley tracks. The smithy is fitted with two fires and a power hammer.

An electrically-driven traverser, 33 ft. wide with a run of 145 ft., has been constructed to serve the wheel and truck, electrical, paint, and body shops, and overhead runways and trolley tracks have been laid along the main passages.

Spacious and convenient rooms have been provided for dining, billiards, and club quarters, so that the staff



Plan of Bolton Tramways Repair Shop.

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have been well provided for. To add to the comfort of the men the buildings have been fitted throughout with a system of hot air and steam pipes.

The main contract for the building work was carried out by Messrs. William Townson and Sons, Limited,

Turning and Fitting Shop—Bolton Tramways.

Bolton, various sub-contracts being also let to local firms. Other contracts were as follow:

Heating and ventilating—J. Wm. Witter, Bolton.
Patent glazing—Messrs. Heywood, Huddersfield.
Revolving shutters—William Mallinson, Manchester.
Pneumatic dust removing plant—A. Ransome and Company, Limited, Newark-on-Trent.
Electric lighting and wiring—Bolton Corporation.
Gas fitting—Bolton Corporation.
Impregnating plant—Dryers, Limited, Manchester.

A Main Passage with Stores on Both Sides.

Steel bins—Estler Brothers, London.
Sanitary fittings—Wm. Pickup and Company, Limited.
Prismatic lights—Hayward Brothers and Eckstein, Limited, Manchester.
Travelling crane—Messrs. Hick, Hargreaves, and Company, Limited, Bolton.

The whole of the work has been carried out from the designs and under the superintendence of Mr. E. L. Morgan, borough engineer and surveyor, and his staff.

BRITISH v. FOREIGN ELECTRIC MOTORS.

Little notice seems to have been taken of the probability that the London, Brighton, and South Coast Railway Company will again obtain motors for their new electric rolling stock from abroad. When the original arrangements were made for equipping the lines of the company which are now worked electrically, motors of foreign design were decided on, and this fact gave rise to a good deal of comment, but it was said that most of these machines would be manufactured in this country. *The Railway Times*, in discussing the arrangements that have recently been made, says that so far as can be ascertained the earlier anticipation was not fulfilled, and that all or practically all the motors used on the Brighton Railway were imported. The matter is of some importance, for a great deal of new electric rolling stock is required for the additional routes which the London and Brighton Company are now about to electrify. A contract has been given to the Metropolitan Carriage, Wagon, and Finance Company for the supply of the motor coaches, including their electrical equipment. Now, this company does not make electric motors, and they will have to obtain these from some other firm whose business is the manufacture of electrical machinery. It seems only too likely, as *The Railway Times* points out, that the order will again go to a foreign firm. The London, Brighton, and South Coast Railway is a fine English undertaking, laid on English soil, and making its revenue for the most part out of English people. When its directors have orders to place, why, our contemporary pertinently inquires, should they not make such provision as will allow the work to be done in this country? There appear to be only two possible excuses. One is that British makers' prices are higher than foreign ones, and the other that British firms have had comparatively little experience in building single-phase traction motors which is the type required by the Brighton Company. If the first of these pleas were put forward, the answer would be that the British manufacturer would probably cut his price if necessary, and that even if a little more were paid by the railway company there would be compensating advantages from the work being done in this country, such as the opportunity of regular systematic inspection during manufacture, and absolute certainty as to quality of materials and workmanship. If the second plea were advanced, it could be replied that though single-phase traction motors have not yet been largely made in this country, single-phase motors for other purposes are familiar enough, and no difficulty would be found in securing satisfactory guarantees from several British firms who are quite capable of turning out the required machines. The Brighton Company's engineers may be trusted to get what they want from our great electrical manufacturing companies. The great bulk of the direct-current motors running on British electric railways at the present day were made by British firms, and no complaint has arisen of their quality or performance. There is nothing *sacrosanct* about a single-phase motor as compared with a direct-current one; the firm which can make a good machine of the latter class may be entrusted with the manufacture of the former. In that case a comparison would be possible between the performance of the foreign motors now in use and British ones of the same type. At the present juncture when the electric equipment of railways is making increasing progress all over the world, it may be greatly to the disadvantage of British manufacturers that the impression should be fostered by the action of a British railway that their requirements cannot be suitably met by our own electrical works.

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The Rating of Tramways.

It is satisfactory to be able to record that the appeal in the case of the Tottenham Urban District Council *v.* The Metropolitan Electric Tramways, Limited, has now been set down for hearing in the House of Lords. The appeal accordingly is likely to come on during this spring, and we shall have the question decided once and for all on what basis tramways in England are to be rated. It is now a considerable time since the judgment of the Court of Appeal was given in the case, and indeed for a few months after that event it appeared doubtful whether the case—highly important as it is—would be taken to the House of Lords. The point to be decided may be briefly recalled. In the past tramways in England have been rated on their full net annual value, while of course railways under a special provision of the Public Health Act are rated on only one-fourth of their net annual value. In Scotland, tramways as a rule are rated in the same way as railways. Years ago an attempt was made to get tramways in England put on the same footing as railways in the matter of rating, but the courts refused, and the point was never brought before the supreme tribunal. A few years ago the Wakefield light railway case came before the courts, and they held that a line authorised under the Light Railways Act is a railway even though it is laid on public streets and is indistinguishable from a tramway. Hence all light railways, whether on private land or on streets, are now liable to pay rates on only one-fourth of their annual value. Next came the Tottenham case. There is a certain continuous length of rails laid on roads in that district, part of which was authorised as a light railway and part as a tramway. The former is rated on one-fourth of its annual value and the latter on its full annual value. The general style of construction of both parts is the same, and the same cars run right through over both sections. The tramway company wished to be rated as regards the tramway on the same basis as regards the light railway, and the Court of Appeal, giving effect to this view, has held that the tramway should be rated on one-fourth of its annual value. In doing so it was made clear that the decision had nothing to do with the fact that the tramway in question is a continuation of a light railway. The judgment was on the broad and general ground that a tramway is essentially a railway, and must be treated as such for the purposes of rating. Moreover, it has already been held that the expression "land used as a railway" in one of the Acts does not solely mean land used exclusively as a railway, but also includes land used as a railway as well as for other purposes, namely, general street traffic. The point to be decided is manifestly of great importance to tramway companies, but it is also of importance to those municipalities working tramways who wish their tramway accounts to show as favourable results as possible. Though in the municipal case the paying of rates on tramways may be only shifting money from one pocket to another, the success of the contention that a tramway is a railway would be of great benefit to some struggling municipal tramway concerns. For every £100 that they now pay over to another municipal department as rates on the tracks, they would have to pay only £25. From all points of view the result will be watched for intently.

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Carriage of Goods by Tramways.

The successful handling of parcels up to 2 cwt. in weight by the Burnley Corporation Tramways, which was described in a recent issue, has attracted some attention in India. In a recent issue of *Indian Engineering*, of Calcutta, it is suggested that Mr. Henry Mozley's system could well be developed into a regular service across the Ganges from Howrah, the terminus of the East Indian Railway, to the godowns, or warehouses, of the merchants in Calcutta when the new floating bridge has been completed. This is not the only place where tramways could be utilised for goods traffic, in fact, goods and minerals have been regularly so carried in Leeds, Huddersfield, and Dublin, and tram lines have even been laid near Glasgow and at Deptford whereon railway wagons can run. Any saving in the labour of handling merchandise, of whatever kind, tends to reduce the cost thereof to the advantage both of the producer and of the consumer, while it enlarges the gathering ground of the railway or port serving it. The advantage of such saving has been studied almost as a fine art by the Americans, while the proposals embodied in the general goods clearing house for London are founded on the same principle. In very many towns out of England the principle is carried to great perfection. Take Mechlin or Malines for example. Here the tram rails are physically connected with the railway in the goods yard, and wagons are drawn, at a slow pace, by a light engine right through the town and beyond, while sidings are run into private yards and warehouses on or near the road side. The advantage of private sidings has been realised to an enormous extent on the railways in the United Kingdom, as the Clearing House Handbook of Stations shows at a glance. Take Bradford for instance. There there are no less than 23 private sidings into stores, abattoirs, corporation yards, gas, and other establishments, including destructors, iron, loom, stone, sawing, coal, and cement works. The greater number of these have been built where they are because of the railway facilities, and the same thing would happen along tram lines in course of time, especially were they adapted to railway rolling stock. The disadvantage of a wider groove in the rail is not felt much when the ordinary road traffic is not intense; moreover, the increasing use of wide rubber tyres on motor vehicles and trailers is gradually doing away with the greater part of the inconvenience of such more open grooves. Meanwhile, the present tram rails might very well be used for special goods lorries to run on, such lorries to be taken alongside the railway wagons at goods yards, and to run into private premises on sidings laid for that purpose. It is a question whether such traffic would not best be served by little electric locomotives as at Nice, as lately shown in these pages. Such locomotives might carry sufficient battery power to take them into and out of the sidings. In building work it is quite usual for road wagons to be loaded with four or six crates of stone, bricks, cement, or what not. On arrival at destination these crates are lifted up out of the lorries by the Scotch or quarry crane, now so universally used, and the contents are taken out on the part of the scaffolding where they are closest to the work for which they are required. If this system of crates or skips were introduced in the case of all goods intended for transport by tram lines from the railway goods yards to private premises, the work would be greatly facilitated. The transfer in the yards could be effected by the usual portable cranes, and on the private premises the contents of the crates would be discharged by hand or be tipped out with the help of cranes for that purpose. This has been done by the help of skips for the transport of material to the site of the new reservoir at Leeds. The saving in the upkeep of roads much used by heavy goods lorries, even when these have rubber tyres, would be very great, and the economy of employing the power plant almost continuously would also greatly reduce the cost per unit, and therefore increase its general use, whether the power-stations were in municipal or in other hands; it may, therefore, be expected that in the course of time tramway undertakings will enjoy the benefits of a new and very profitable source of revenue, of which many of them are sorely in need. Prominent business men in Manchester and the district have, it is reported, long favoured a scheme for using the tram lines during the night for the conveyance of goods to and from the Manchester docks to outlying towns, even as far as Liverpool.

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ENERGY CONSUMPTION AS A MEASURE OF MAINTENANCE COSTS IN TRAMWAY WORKING.

It has been pointed out before in these columns that to express the cost of maintenance of a tramway undertaking in terms of car-miles is not so satisfactory as to express it in terms of the energy consumed. The only object served by either form of expression is the institution of comparisons whereby the manager or his critic may gauge the efficiency and economy of expenditure under this head, and the latter basis permits wider comparisons and comparisons which are safer to make. The reason is that nearly all the damage and deterioration to which the physical conditon of a tramway undertaking is subject is attributable to the quantity of energy dissipated. That the cost of making good the damage and deterioration so caused should be proportional to the quantity of energy is an inference which will commend itself to the minds of most people, and it is happily one that seems to be confirmed by the test of actual experience, as the figures given later tend to show. When the car-mile is used as the basis of comparison, we have a standard which is similar in few undertakings, because the car-mile may differ in three respects—in weight, speed between stops, and number of stops per mile, all of which affect its uniformity as a standard. When the unit of energy is chosen as the basis of comparison, however much the services compared may differ in any of the above particulars, we have a standard in quantity of energy dissipated which is the same for all; and although the proportion dissipated in destructive vibration or detrition by friction cannot be strictly the same in differently designed systems of permanent way and rolling stock, yet, since the character of the materials employed is the same in all cases and their general disposition very similar, it is reasonable to assume that the damage and deterioration inflicted cannot be very different. A discordant element is introduced by the weather, and on lines of very light traffic it might exercise a great influence on the cost of maintenance, but in the majority of cases the construction of a tramway is not undertaken unless it is to be used to an extent that insures every part, or almost every part, shall be worn out before it fail from rust or decay brought about by weather or other causes having no relation with the current consumption. The repair of the road between the tram lines is not maintenance strictly proper to a tramway, and where it cannot be separated a certain discrepancy is introduced which is, however, palliated by the fact that the density of service is likely to be roughly proportional to the density of the other vehicular traffic. An example of the superiority of the B.T.U. over the car-mile as a basis for comparison of maintenance charges is afforded in the records of electric tramway accounts published elsewhere in this issue. The expenditure on maintenance varies very greatly in the several undertakings represented, because the policy pursued is not uniform; but if a sufficient number of records be taken, the average obtained will suffice for a guide. Looking down the column headed *units used per car*, it will be observed that the figures may be under 1 and over 2. The tramways using less than one are disregarded, because these have so light a traffic that the discrepancies arising from weather and road repair are likely to be exaggerated. This limitation, however, rules out only five tramways. There are 15 tramways using from 1 to 1·2 units per car-mile, which we may take as constituting between them a typical system of light traffic as far as cost of maintenance is concerned; and 16 using over 1·6 units, which may be taken to represent the cost of maintenance under heavier conditions of traffic. London is omitted, because the conduit system is there in use. The list of both lots are set out in the following table, together with the cost of maintenance in each case expressed as pence per B.T.U. used and as pence per car-mile respectively. It will be seen that the averages of the former differ by under 10 per cent., while the difference between the averages of the latter is many times as much. The result, of course, is not conclusive, but it at least affords corroborative evidence that *energy consumed* is a better basis than "car-miles" for gauging the "cost of maintenance," because comparisons based on the former have a wider application.

COST OF MAINTENANCE IN PENCE.

Tramway.	Per Unit of Current Used.	Per Car-mile.
	d.	d.
Aberdeen	·757	·870
Burton-on-Trent ...	·291	·330
Chester	·500	·570
Ipswich	1·300	1·300
Keighley	·823	·866
Kilmarnock	·703	·769
Lincoln	1·420	1·560
Nelson	1·720	2·040
Southport	·870	1·033
South Shields	·655	·729
Sunderland	·630	·721
Walsall	1·250	1·429
Walthamstow	1·050	1·240
Warrington	1·470	1·760
Portsmouth	·960	1·004
Average	1·027	1·081

COST OF MAINTENANCE IN PENCE.

Tramway.	Per Unit of Current Used.	Per Car-mile.
	d.	d.
Blackburn	1·330	2·410
Bradford	·720	1·320
Darwen	1·330	2·224
Dundee	·740	1·306
Halifax	·990	1·678
Liverpool...	·830	1·567
Manchester	·651	1·080
Nottingham	·690	1·200
Oldham	1·150	2·110
Rotherham	·920	1·729
West Ham	·865	1·461
Birkenhead	1·038	2·076
Huddersfield	1·930	·870
Leeds	·605	1·076
Manchester	·820	1·565
Sheffield	·670	1·198
Average	·955	1·554

P-A-Y-E CARS FOR LEICESTER.

The ten new cars constructed under the patents of the Pay-As-You-Enter Tramcar Company, Limited, for Leicester Corporation Tramways are now practically ready for service, and one of them is illustrated on the following page. The cars will first be run on the Narborough route, and they will be put in commission about the middle of this month. As the cars are of the double-deck type, and will be tested on a busy route, the P-A-Y-E system will thus be given a thorough trial. Mr. Lucas, the manager of the Leicester Corporation Tramways, is enthusiastically in favour of the innovation, and sanguine of its success both from the point of view of the convenience and safety of the public and the monetary advantage of the undertaking. As passengers will enter at one end of the car and alight at the other, there can be no doubt that it will give a freer circulation through the car, and so economise time at busy stopping places. The fact that the conductor will always remain on the platform, and can thus watch

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Conductor Issuing Tickets on Rear Platform.

Entering at the Rear and Alighting from the Front.

P-A-Y-E Cars for Leicester Corporation Tramways.

more closely than at present the safety of passengers, accounts largely for the almost universal use of the system in America, where accidents have much diminished as a consequence. If we may judge by the statement issued by the directors of the Gateshead and District Tramways Company as to the dividend to be paid on the past year's working, it is safe to assume that the experimental operating on one section of cars fitted up for payment of fare on entry has contributed to the improved results. The directors recommend a dividend at the rate of 7 per cent. per annum on the ordinary shares for the half-year ended December 31, 1912, making with an interim dividend a total of 6 per cent. for the year, and a bonus of 1 per cent. paid on the ordinary shares. Last year the return for the year was at the rate of 6 per cent. The P-A Y-E system was instituted on June 25 last on the single-deck cars running on a route where the fare is one penny.

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LONDON MOTOR TRAFFIC INQUIRY.

EVIDENCE BY THE CHIEF OFFICER OF THE COUNTY COUNCIL TRAMWAYS.

The House of Commons Committee which is enquiring into the cause of accidents from power-propelled traffic in London, and into the best means of securing the safety of pedestrians, on February 4 heard the police evidence in regard to the allegation made against the County Council, that their employees are instructed not to make any statement to the police as to what has taken place in case of tramcar accidents, or to give the names and addresses of any witnesses they may have obtained before the police arrive on the scene. Subsequently, Mr. A. L. C. Fell, the chief tramways officer, explained the whole of the circumstances. The procedure seems to have been for the police, after having failed to obtain what they require on the spot, to call at the tramway offices, usually at a most inconvenient time, and ask to be allowed to interview a particular driver or conductor. If the request has been granted, the interview has usually taken place in the presence of an official, who intervenes to prevent any statement being made which is considered likely to prove prejudicial to the interests either of the driver himself or to the County Council in respect of third-party claims. Altogether, four instances of this character were mentioned. Mr. Fell explained that at the end of 1904, he had to take into consideration the position that statements made by drivers and conductors on the spur of the moment, were frequently used against the men subsequently, and being also available to any member of the public on payment of a shilling, were often used to further third-party claims for compensation. Therefore, early in 1905, and in his own discretion as having complete charge of the undertaking, he issued a notice to the effect that employees were to furnish no information to the police in the case of accidents, beyond giving their badge and car numbers. Towards the end of 1905, the Commissioner of Police wrote to him with regard to the matter, and an interview took place, with the result that it was agreed between Mr. Fell and the Commissioner's representative that the notice should continue in force, and that a police officer should be allowed to interview any driver or conductor concerning an accident, at the Council's offices in the presence of a tramway official, any such statement not to be used against the men for purposes of prosecution.

Veto of the Borough Councils on Tramway Schemes.

Sir Laurence Gomme, clerk to the County Council, also gave evidence. He pointed out that in some degree the following have a hand in London traffic, namely, the Home Office, Board of Trade, Local Government Board, Post Office, County Council, Metropolitan Police, City Police, 28 Borough Councils, Metropolitan Water Board, certain railway, gas, and electric light companies, London Hydraulic Power Company, and the Office of Works as regards the parks. The witness urged the desirability of doing something to co-ordinate these authorities, and bring the control into one hand. He strongly complained of the position which the County Council is put into in respect of its tramways, especially by reason of the veto of the borough councils. The result was that the County Council, working for the good of London as a whole, were frequently stopped by the veto from introducing tramway schemes. If they overcame this difficulty, they were sometimes met with adverse reports by the Home Office or by the Board of Trade. As an instance, he mentioned the proposal last session to run trailer cars, when two departments of the Government which had constituted the Council the tramway department gave opposite views as to the desirability or otherwise of running trailer cars, which were considered by the Council essential to facilitate the traffic. He claimed that the Council should have as complete control of its tramways as is the case with tramway committees in the provinces. The police might exercise a little more stringently the general powers over motor vehicles. In this connection, he mentioned the practice of motor 'buses endeavouring to draw out from behind slower-moving traffic, and to do so, having to practically turn at right angles to the thoroughfare, thus involving a risk of accident from vehicles coming in the opposite direction. This, he thought, should be an offence. Further working arrangements between the transport authorities in the London area should be encouraged.

Sir Laurence Gomme was under cross-examination during the whole of February 6, when a considerable amount of attention on the part of the Committee was devoted to the question of a Traffic Board for London. Sir Laurence has not changed his opinion, which he expressed before the Royal Commission on London traffic, that the authority might well be the County Council.

Mr. Goldsmith, Mr. Harris, and the Earl of Kerry on one side of the table, dissented from the proposition that the Council should be the traffic authority, whilst on the other side there were Mr. Allen Baker, Mr. Collins, Mr. Morrison, Mr. Kellaway, and Mr. Thorne, all in agreement that the Council should be the authority. Another aspect of Sir Laurence Gomme's evidence was his emphatic view that he does not believe in competition in traffic, and it seems to him a ridiculous position for London to be subject to the results of competition rather than the results of organisation of its transit facilities. He regards it as a simple matter to devise a scheme whereby tramways, underground railways, and omnibuses could be so regulated and worked together that the greatest possible efficiency would be obtained, with the consequent elimination of overlapping and competitive services. Mr. Morrison expressed a keen desire to have a rough idea of how this could be carried out, and Sir Laurence promised to let him have one. In his advocacy of the abolition of the veto, the witness rather carried practically the whole of the Committee with him, although one or two members would object to the borough councils' veto going if the County Council were to be constituted the traffic authority. The general impression is that the veto should be abolished, but that the Council and the borough councils should fight the matter out before Parliament.

Accident Statistics of the County Council Tramways.

The Committee completed their sittings for the session on February 13, some progress having previously been made on February 11 with the evidence from Mr. A. L. C. Fell, chief officer of the County Council Tramways, who before taking up that position in 1903 was general manager and electrical engineer of the Sheffield Corporation Tramways. Mr. Fell, in 1908-9, was president of the Municipal Tramways Association, and he is a member of the Council of the Tramways and Light Railways Association. In his official capacity he has charge of the whole of the Council's tramways undertaking, and the control of over 11,000 employees. During the course of his evidence, Mr. Fell submitted about two dozen diagrams, charts, and tables.

The total length of the tramway system, Mr. Fell said, was 149·1299 street miles, all but about 11½ miles being double lines. One hundred and forty miles were worked electrically, 111½ miles being double-line conduit, 4½ miles single-line conduit, 20½ miles double-line overhead, and 3½ miles single-line overhead. He submitted a list of the places where the rails are less than 9 ft. 6 in. from the kerb,

NUMBER OF FATAL ACCIDENTS IN RELATION TO THE WIDTH OF ROAD OCCURRING ON THE TRAMWAYS OUT OF A TOTAL OF 146 FATAL ACCIDENTS WHICH OCCURRED BETWEEN MARCH 31, 1907, AND DECEMBER 31, 1912.

5	occurred where the width of road is under 32 ft. 6 in.
37	" " " " between 32 ft. 6 in. and 36 ft. 0 in.
45	" " " " " 36 ft. 0 in. and 40 ft. 0 in.
59	" " " " 40 ft. 0 in. and over.
146	

and also a list of fatalities and non-fatal accidents which had occurred at or near these points since March 31, 1907, to December 31, 1912. Only one fatal accident was in any way attributable to the rails being less than 9 ft. 6 in. from the kerb, and in this case a motor lorry rushed in between the car and the kerb, crushing the man, aged 84, against the car. In only one non-fatal mishap could the fact that there was less than 9 ft. 6 in. between rail and kerb have had any bearing on the accident. In this case an intoxicated person reeled off the pavement and fell on to the track in front of the car. The number of electric cars on December 31 was 1,565, as compared with 1,489 in 1911 and 1,359 in 1910. In 1911-12 the number of passengers carried was 553,440,235, of that number 61,806,125, or 11·58 per cent., were carried at workmen's fares. The number of car-miles run was 50,487,812. In 1903 the passengers numbered 133,139,085, and the car-miles 11,536,536.

During the period from April 1, 1907, to December 31, 1912, the number of fatal accidents was 146. Ninety-five were men, 35 women, and 16 children. On the other hand, there were 1,565 cars, which in 1912 carried 533,440,235 passengers. Between 39 and 40 per cent. of the fatal accidents were caused by persons being knocked down by the front of the cars, and 24 per cent. by people attempting to board or alight from cars in motion, and to personal negligence in other ways. 14·39 per cent. were caused by collisions between other vehicles and the cars, and 10·9 per cent. by persons being knocked down by the sides of the cars. Accidents of the last class were caused, as a rule, by people trying to dodge other traffic.

There was no doubt that the majority of accidents common to street locomotion were caused by the front part of the vehicles. The large carrying capacity of the Council's cars made it possible to run fewer vehicles, and reduced the number of fronts or points of impact as compared with other public vehicles.

A table submitted by Mr. Fell showed the months of the year and the hours of the day at which fatal accidents occurred between April 1, 1907, and December 31, 1912. The greater number of accidents occurred in September, October, and November, but foggy evenings and dark nights did not appear to have had any material influence on the number of accidents, as there was considerable decrease in December,

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January, and February. This was probably partly due to the circumstance that at such a time there were fewer passengers. A table of the days of the week and the hours of the day at which fatal accidents occurred from April 1, 1907, to December 31, 1912, showed that out of the total of 146—34 or 23·29 per cent. occurred on Saturdays, 23 or 15·75 per cent. on Mondays, 21 or 14·38 per cent. on Sundays, 20 or 13·70 per cent. on Tuesdays, 20 or 13·70 per cent. on Thursdays, 14 or 9·59 per cent. on Wednesdays, and 14 or 9·59 per cent. on Fridays. Of the 34 which occurred on Saturdays, only one occurred before mid-day, and 33 happened between 12 noon and midnight. One reason for the greater number of accidents on Saturdays was that a full service of cars was in operation after mid-day until late at night, whereas on ordinary weekdays between 35 to 40 per cent. of the cars were withdrawn from service between 10 a.m. and 5 p.m., and a large number of cars are also sent into the depots after 8-30 p.m. It would be seen that out of the total of 146 accidents, 28 or 19 18 per cent. occurred between 12 midnight and noon, and 118 or 80·82 per cent. between noon and midnight. 5 or 3·43 per cent. occurred between midnight and 6 a.m., 23 or 15·75 per cent. between 6 a.m. and noon, 54 or 36·99 per cent. between noon and 6 p.m., and 64 or 43·83 per cent. between 6 p.m. and midnight. The critical period of the day was apparently between 10 and 11 p.m. Out of the total of 15 which occurred between these hours five happened on Sundays.

An appendix showed the number of fatal accidents from April 1, 1907, to December 31, 1912, classified according to ages. It would be noted that out of 146 fatal accidents—20 occurred between the ages of one to 20, 28 between 21 to 40, 49 between 41 to 60, and 49 between 60 to 85. Putting the same figures in another way, it would be seen that 48 fatal accidents occurred to persons up to and including the age of 40, and 98 to persons of 41 years of age and upwards.

Progressive Decrease in Fatalities.

The following table showed in detail the total number of car-miles run compared with the total number of fatal accidents for the five years ended March 31, 1912. Mr. Fell said it would be clearly seen from this that whilst the number of car-miles had enormously increased, the number of fatal accidents has remained almost constant.

TABLE SHOWING NUMBER OF ELECTRIC CAR-MILES RUN PER FATAL ACCIDENT.

Year.	Number of Fatal Accidents.	Number of Car-miles run.	Car-miles run per Fatal Accident.
1907–8 ..	19	25,591,028	1,346,896
1908–9 ..	25	31,962,784	1,278,511
1909–10 ..	25	39,545,512	1,581,820
1910–11 ..	34	45,744,066	1,345,413
1911–12 ..	26	48,777,026	1,876,039

The figures for 9 months from March 31 to December 31, 1912, showed: Car-miles run, 39,052,989; fatal accidents, 17; car-miles run per fatal accident, 2,297,235. Since 1907 there had been a progressive decrease in the number of fatal accidents in proportion to the number of car-miles run. In his view that improvement was mainly due to the increased experience of tramcar drivers.

Mr. Shirley Benn: Is is not due at all to the public taking more care?—There is no doubt the public have awakened up during the last few years.

The appended table gave the number of passengers carried on the Council's tramways, and the number of passengers carried per fatal accident during the period of five years ended March 31, 1912.

TABLE SHOWING NUMBER OF PASSENGERS CARRIED BY ELECTRIC TRAMCARS PER FATAL ACCIDENT.

Year.	Number of Fatal Accidents.	Number of Passengers carried.	Number of Passengers carried per Fatal Accident.
1907–8 ..	19	279,166,461	14,692,972
1908–9	25	344,705,937	13,788,237
1909–10 ..	25	418,317,377	16,732,695
1910–11 ..	34	482,296,935	14,185,204
1911–12 ..	26	516,092,489	19,849,711

Figures for nine months from March 31, 1912, to December 31, 1912: Passengers carried, 379,057,209; fatal accidents, 17; passengers carried per fatal accident, 22,297,483. Although the number of tramway passengers had greatly increased, there had been no corresponding increase in the number of fatal accidents. The witness handed in a map showing the location of all the fatal accidents which occurred between March 31, 1907, and December 31, 1912. The position of each accident was indicated by a red circular spot.

The narrow places which were tabulated were indicated in green. This indicated that fatal accidents did not occur solely in congested areas, but were spread generally over the whole system.

The following table was an analysis of the principal causes of non-fatal accidents which were reported to the Board of Trade during the three years ended December 31, 1912; 32·40 per cent. of these were caused by persons being knocked down by the front of the car; 28·82 per cent. were caused by collisions between other vehicles and tramcars; 24·59 per cent. of the cases were caused by persons attempting to board or alight from cars in motion. The total number of non-fatal accidents in 1912 was 302. The figure given by Sir A. Yorke was 306. The latter total included four electrical occurrences, viz., two cases of broken trolley wire, one case of controller fusing, in which no one was injured, and one case of an electric shock to a conductor changing the indicator.

TABLE GIVING ANALYSIS OF THE PRINCIPAL CAUSES OF NON-FATAL ACCIDENTS REPORTED TO THE BOARD OF TRADE DURING THE THREE YEARS ENDED DECEMBER 31, 1912, IN CONNECTION WITH THE WORKING OF ELECTRIC TRAMWAYS.

Item No.	Nature of Accident.	January 1, 1910, to December 31, 1912.	Percentage to Total.
1	Persons knocked by front of car	452	32·40
2	Collisions between tramcars and other vehicles	402	28·82
3	Persons attempting to board or alight from cars in motion	343	24·59
4	Collisions between tramcars	73	5·23
5	Persons knocked down by side of car	47	3·37
6	Persons falling down staircase	25	1·79
7	Persons injured through sudden application of brake	11	·79
8	Cases not coming under above heads .. .	42	3·01
	Total	1,395	100·00

The greatest number of non-fatal accidents occurred during October and December. During the year 1912, out of a total of 302 non-fatal accidents 85 or 28·15 per cent. occurred between midnight and noon, and 217 or 71·85 per cent. between noon and midnight; 3 or 0·99 per cent. of accidents occurred between the hours of 12 midnight and 6 a.m.; 82 or 27·15 per cent. between 6 a.m. and noon: 107 or 35·43 per cent. between noon and 6 p.m.; 110 or 36·43 per cent. between 6 p.m. and midnight. As regarded the days of the week, 59 or 19·54 per cent. of the non-fatal accidents occurred on Saturdays, 52 or 17·22 per cent. on Mondays, 46 or 15·23 per cent. on Tuesdays, 44 or 14·57 per cent. on Fridays, 40 or 13·24 per cent. on Thursdays, 36 or 11·92 per cent. on Wednesdays, and 25 or 8·28 per cent. on Sundays. Of the 59 which occurred on Saturdays, only 12 occurred before noon and 47 between noon and midnight.

Efficiency of Life-Guards and Brakes.

The remainder of Mr. Fell's evidence dealt with the precautions taken by the tramway department to prevent accidents. Every precaution and reliable device for reducing danger to a minimum had been, Mr. Fell said, adopted in connection with the Council's tramways. The principal measures adopted were as follow: A most efficient form of life-guard was fitted to all cars, and the pattern now in use had been approved by the Board of Trade. Motormen had strict instructions to drop the life-guards when leaving their cars in the depot on the completion of a duty. This instruction ensured the testing of the life-guards of all cars in service at least once a day. The efficiency of the life-guard was demonstrated by the fact that, between January 1, 1910, and December 31, 1912, it was brought into use on 135 occasions, as shown in the following table. In 130 cases its action was successful,

SUMMARY OF THE CASES IN WHICH THE LIFE-GUARD WAS BROUGHT INTO USE ON THE LONDON COUNTY COUNCIL TRAMWAYS FROM JANUARY 1, 1910, TO DECEMBER 31, 1912.

	1910.	1911.	1912.	Total.
Life-guard used successfully:				
Non-fatal cases	62	23	36	121
Fatal cases	—	4	5	9
	62	27	41	130
Life-guard used unsuccessfully:				
Non-fatal cases	—	1	1	2
Fatal cases	—	2	1	3
	62	30	43*	135

* This figure was given by Sir H. A. Yorke.

whilst only in five cases was it unsuccessful. These were accidents to children. Mr. Fell pointed out that it was impossible to bring the hanging gate of the life-guard very near to the surface of the road, and although the centre of the tray of the life-guard was in contact with the road, the unevenness or camber of the paving created a space between the outside edges of the tray and the paving. The clothing of the children in the cases referred to might have passed under the tray owing to this cause.

The Chief Officer said he had made a special study of brakes for tramcars, and had conducted exhaustive tests. The Council's cars

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were fitted with the most up-to-date and efficient electro-magnetic and mechanical brakes. Mechanical attachments were provided on the cars running on steep gradients, for example, on Dog Kennel Hill, where the gradient was 1 in 10·6, by means of which the magnetic brake shoe could be pressed down to the rail by hand. A special slot brake was provided on all cars running on the Highgate Hill section, where the steepest gradient was 1 in 10·7 The efficiency of the various types of brakes could be demonstrated to the Committee under actual working conditions if considered desirable.

The distance in which cars could be brought to a standstill by the magnetic brakes under emergency and service conditions was 42 ft. and 78 ft. respectively when the car was travelling 16 miles an hour, and 53 ft. and 95 ft respectively when the rate was 18 miles an hour. The emergency brake would stop a car running at eight miles an hour within 11 ft., and the service brake within 22 ft., without causing any

TABLE OF DISTANCES IN WHICH ELECTRIC CARS COULD BE STOPPED WHEN RUNNING AT VARIOUS SPEEDS.

Speed	Emergency Stopping Distance.	Service Stopping Distance.
2 miles per hour	3·0 feet	4·0 feet
4 " "	3·3 "	5·7 "
6 " "	6·4 "	12·8 "
8 " "	11·3 "	2·15 "
10 " "	16·4 "	30·0 "
12 " "	23 5 "	44·0 "
14 " "	32·0 "	60·0 "
16 " "	42·0 "	78·0 "
18 " "	53·0 "	95·0 "

inconvenience to passengers. The maximum speed down Highgate Hill allowed by the Board of Trade was eight miles. When Sir Arthur Yorke was inspecting the section the car was driven down at full speed, and the special slot brake pulled up the car in a remarkably short distance. A member of the Committee instituted comparisons between the speed of a motor car on a greasy road and a tramcar on a greasy rail from the point of view of its ability to pull up quickly, and whilst Mr. Fell definitely expressed the opinion that it was much safer to run a tramcar at high speeds under these conditions than a motor car, one or two members of the Committee differed from him.

Mr. Fell next dealt fully with the training of motormen. In selecting candidates preference was given to men who had had previous experience in driving vehicles in London. All these men, he said, had a practical knowledge of speeds. On certain routes where gradients were severe only experienced motormen were employed. For example, on Dog Kennel Hill and Highgate Hill two years' experience was necessary. A book of rules and regulations was issued to each motorman and the witness drew attention to some of the rules framed for the protection of the public.

Objections to Speed Indicators.

The question of speed indicators, Mr. Fell said, had been under consideration for a very long time, and various types of indicators had been tested on the Council's tramways. The principal objections to the general adoption of speed indicators were as follow:

1. The instruments are by no means reliable, chiefly owing to the difficulties which arise in the transmission gear. In a motor car this gearing is comparatively short and free from complications, but in a tramcar it is over 30 ft. in length, and complicated by various fittings in which the direction of the drive is changed.
2. As the speed indicator is driven from the car axle its accuracy is affected by variations in the wheel diameters. The diameter of the driving wheels of the Council's tramcars varies from 31¾ in. when the wheels are quite new to 28¾ in. when the tyres are worn out, so that even if the instruments are calibrated for the mean diameter there will still be considerable inaccuracy when tyres are either new or nearly worn out.
3. On a greasy rail there is considerable slip between the driving wheels and the rails. This is especially the case when the car is rapidly accelerated, so that a speed indicator in the case of a 4-wheeled car, where the indicator is necessarily driven from a driving axle, would register a very much higher speed than the speed at which the car was actually travelling whilst the slipping continued.
4. It is much better that a motorman should concentrate his attention on driving his car and keeping a sharp look-out for other traffic, than that he should have his attention fixed on the speed indicator.
5. The cost of installation, employing indicators at either end of the car, may be from £25 to £30, while as regards maintenance, although no reliable figures are available, it is abundantly clear from the trials that have been made that this would be very considerable. The greater part of this expenditure arises out of the necessity of providing flexible gearing running the full length of the car to transmit the motion of the road wheels to the indicators.
6. The proportion of instruments out of order at any time would inevitably be high, and as their correction is a matter involving a considerable degree of skill, it could not be undertaken in the running sheds without considerable difficulty and expense. Moreover, there is considerable risk of a car going into service with the speed indicator reading very inaccurately, and the motorman would thereby be deceived in his handling of the car.
7. No indicator which rings a bell or gives a warning sound when the maximum speed is attained is of much value, as the safe speeds vary widely at different parts of the route. At one time it may be perfectly safe to run at a speed of 16 miles an hour, whereas it might be dangerous on another part of the route to exceed six miles.

Safety Precautions—Obstruction of Tramways.

Mr. Fell added that at important junctions, cross roads, etc., the positions of compulsory stopping places were fixed by the Board of Trade. The County Council were empowered to fix stopping places by Act of Parliament. These stopping places had been fixed at an average distance of 200 yards apart, and were divided into two classes: (1) Points at which all cars stop; (2) stops by request. As to the desirability, or otherwise, of continuing the system of fixed stopping places, in the witness's opinion it was not desirable to pick up and set down passengers at any point for the following reasons: (1) The conductor could not possibly always be on the rear platform of a car, and the motorman would have to constantly look out for passengers instead of attending to the driving of the car. (2) There was less danger in passengers waiting at a definite point and crossing the road together to board the car than if they had to cross the traffic separately at various points along the route. (3) If the system at present in operation were abandoned, the number of times the car would have to stop would be increased: this would tend to impede the flow of traffic, and increase congestion and its consequent dangers. In the opinion of the witness many more accidents would occur if there were no fixed stopping places.

The following notices were exhibited in conspicuous positions on the cars: (1) Above windows in upper saloon.—"Warning.—The London County Council will not be responsible for accidents caused through passengers leaning over the sides of the car." (2) In ventilator spaces lower saloon, and on glass pannels of doors upper saloon.—"Do not pass behind this car until you know the road is clear." (3) Platforms—staircase stringers.—"Passengers are respectfully requested to keep a sharp look-out for overtaking vehicular traffic when alighting from the car."

Considerable delay and inconvenience to tramway passengers and the public generally was caused, Mr. Fell remarked, by slow-moving vehicles meandering over the centre of the roadway instead of keeping close to the kerb. In considering a by-law submitted by the Council, the Home Secretary suggested that it should apply to a limited number of streets. The Council expressed the opinion that the by-law should apply to greater numbers of the principal streets, and the revised list was now under consideration of the Home Office. It was of the utmost importance that this regulation should apply to all the main streets of London, as a by-law which applied to a limited number of, or even parts of, streets only led to confusion, and tended to aggravate rather than relieve congestion and danger. On this point he quoted the following passage from the report of the Royal Commission on London Traffic, volume 1, page 90, paragraph 198: "We are also of the opinion that all vehicles proceeding at a slow or walking pace should, in the absence of reasonable grounds to the contrary, be required to keep as close as possible to the kerb. If the rule of keeping the slow traffic to the kerb could be generally enforced, it would materially relieve congestion in the streets by tending to separate the slow and fast traffic."

Markets were held in public streets; for instance, High Street, Whitechapel, and Spitalfields In the former case there was a hay market in the centre of the road and stalls at the side, which threw the general traffic on to the tracks. In the latter case only one track could be used for the greater portion of the day on account of the market carts standing on the other track. Certain thoroughfares were virtually used as store yards for trade vehicles. For instance, Tooley Street, where vans were known to have stood at the side of the road for hours together. Dealing with the obstruction from this source, the Royal Commission on London Traffic stated: "It appears to us that the hay market should be removed from Whitechapel High Street. . . . A great hindrance to locomotion is caused by the standing of wagons, vans, and other vehicles at the sides of the streets for loading and unloading."

A great deal of obstruction and risk of accident was caused by vehicles breaking down on the tramway track due to various causes, such as defective wheels and axles, overloading, etc. There was a great need for more systematic inspection of vehicles using public thoroughfares, and if such vehicles were kept in proper condition there was no doubt that the number of accidents, as well as delays and inconvenience, would be considerably reduced. Legislation should be introduced so that the owners of defective vehicles could be penalised.

Stopping Places of Motor 'Buses and Tramcars.

Whilst not desiring to depreciate any service which motor omnibuses rendered to the public, Mr. Fell pointed out that the practice generally prevailing in London with these vehicles cutting in on the near side of tramcars at tramway stopping places was the most serious source of danger and obstruction in London, and had recently been the cause of several fatal accidents. He handed in a number of photographs illustrating this point. The practice referred to was open to the following grave objections: (1) It is a source of serious danger to passengers entering or leaving a tramcar; (2) it keeps the tramcars waiting at stopping places much longer than is necessary, and thus impedes the flow of traffic, which adds to the congestion and consequent dangers of the streets; (3) it tends to increase the time occupied on

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the journey, which means that a greater number of tramcars are required, and thus unnecessarily adds to the congestion of the streets; (4) a practice of this kind naturally prevents the best use being made of the streets, and in the opinion of the witness it is unnecessary obstruction of this kind which largely contributes to the congestion in many thoroughfares.

Emphasis had been laid on the danger of this practice by a representative of the omnibus companies. During the proceedings in the House of Commons on the London County Council (Tramways and Improvements) Bill, 1912, the following question was put by the counsel for the omnibus companies to Mr. R. S. Tilling: "You told us that it is usual to pass on the off side. Is it not, in your judgment, a dangerous thing to pass between the kerb and the tram?" (Question 2413.) Answer: "Yes, because it is a considerable danger to passengers getting off the tramcar."

Mr. Fell had caused observations to be taken at many points on the tramway system and, notwithstanding the statement made by Mr. Tilling, the practice of omnibuses passing tramcars on the near side appeared to be general. Mr. Fell agreed with Commissioner of Police regarding the stopping places of omnibuses, and suggested that 'buses should stop beyond the tramcar and not behind it. He agreed with a suggestion by the chairman, that the plan might be tried experimentally with the co-operation of the omnibus companies.

Mr. Fell came into collision with several members of the Committee, including the chairman, on the question as to whether overtaking traffic should pass a stationary tramcar on the near side or the off side. Mr. Fell favoured the off side, but the chairman pointed to the possible danger of meeting another tramcar when passing in this position, and a good deal of argument between the members of the Committee and witness brought the point back to the one that after all it is best to allow the driver of the overtaking vehicle to use his discretion as to which side he should pass, always with the restriction that he should be legally compelled to stop in order to allow of the free passage of passengers to and from the tramcar. One rather significant suggestion by Mr. Fell was that tramcar drivers have by long experience learned to know the safe speed at which to run their cars under all conditions of traffic, and that from this it followed that no other vehicle should, with proper regard for the safety of the other traffic and people using the road, pass the tramcar. Mr. Fell, whilst in favour of retaining the Board of Trade speed limit for the tramway system, said he would rather rely upon the experience of the drivers to drive at a proper speed consistent with general safety, but the Board of Trade limit was a useful reminder to the driver of the speed which, under the most favourable conditions, he was not allowed to exceed. The chairman was rather doubtful as to the ability of the driver to properly judge speed, seeing that the limits on the tramway system varied from 4 to 16 miles an hour, and that it was possible for one driver to have a journey which included sections having perhaps three or four different speed limits.

Mr. Fell advocated fixed stopping places for motor 'buses as well as for tramways, and throughout his evidence he was for the most part in conflict with Lord Alexander Thynne as to the comparative dangers to be apprehended from the flexibility of the motor 'bus and the fixity of the tramcar. Mr. Fell was all in favour of the tramcar, although it must be stated that he was by no means anxious to institute too sharp comparisons between the two modes of locomotion, and the expressions of opinion which he made on the point were rather forced upon him, not the least by the advocates on the Committee of tramways. Mr. Fell's evidence is a long way from completed, and he will come before the Committee again after the recess.

Evidence of Motor Cab and 'Bus Drivers.

Mr. L. Russell, a motor cab driver with 28 years' experience of driving cabs, was also examined. He favoured regulation of routes and stopping places of motor 'buses, and said the drivers were on duty for 12 hours without proper meal times. He urged the abolition of drivers' mirrors, in order that the driver might give his whole attention to the road. He also referred to the danger of the driver having any sort of enclosure around him, as it prevented him from giving hand signals to other traffic.

Mr. R. E. Cross, president of the National Society of Motor 'Bus Drivers, rather startled the Committee with one or two of his answers. A particular example was one in which he suggested that if people would cross the road carelessly they deserved to be killed. The first serious point he drew attention to was that whereas the Local Government Board Order stated that the maximum speed for motor 'buses was 12 miles an hour, the police would not license a vehicle unless it could travel 16 miles an hour, and from this he had formed the opinion that a motor 'bus driver was entitled to drive at the maximum speed which the motor 'bus would travel. Following up this point, the chairman drew from the witness the fact that motor 'buses could go even more than 16 miles an hour and, indeed, speeds of 20 or 25 miles an hour were again referred to as actually being attained on the ordinary passenger-carrying journeys in London. At the same time, he held the opinion that no driver could tell with any degree of accuracy what speed he was running at between 12 and 20 miles an hour, but several of the committeemen, as drivers of vehicles, did not hesitate to tell the witness that his opinion was one which they did not share. After complaints as to the tramways at such points as Theobald's Road and Rosebery Avenue impeding the progress of the motor bus, and confirming the previous witness's evidence as to the necessity for a period of some two or three years' practical traffic experience before a man should be granted a licence to drive a public vehicle in London, Mr. Cross came to the method upon which omnibus drivers in London are paid. He said that according to the years of service they are paid on the basis of 0·95d., 1·05d., and 1·25d. per mile run, with certain bonuses for freedom from accidents. Thus it was imperative for a driver, if he was getting behind time through the slowness of the travelling, to exceed the speed limit in order to make it up, because every mile which he lost during the day was deducted from his money. The first rate of pay mentioned above was for men under six months' service, the second for men up to two years, and the third for men over two years. He himself had driven a 'bus at from 25 to 26 miles an hour between Twickenham and Walthamstow in order to keep to the time table. He complained of the hours which men have to be in attendance at the garages in order to get in their number of journeys, and finally alleged that the class of men now being taken on as drivers were totally unfitted for the work, many of them being from the country, with no knowledge of London traffic conditions.

The Committee then adjourned, and the members have since recommended the Government to reappoint them next session.

A BRADFORD CAR BLOWN OVER.

On February 7 Bradford was visited by a severe windstorm. When the gale was at its height about 10-30 p.m. a top-covered tramcar belonging to the Corporation was blown over at the Allerton terminus of the Leeds and Bradford Tramways. There were no passengers in the car, but the driver and the conductor were examining the sand boxes. They sustained a few slight cuts, and were able to get out of the car

Bradford Car Overturned by a Gale.

without assistance. Nearly every window was smashed, and owing to the continuance of the gale the raising of the car was postponed until the following morning. The accident is unprecedented in this country. No electric car has ever been blown over, although such occurrences have been known in the case of steam cars. The gauge of the tramway track on which the accident took place is 4ft.

Railless Trolley Bills to be Considered by One Committee.—In respect to the many petitions lodged against the various bills for the promotion of railless trolley traction, largely on the question of compensation for wear and tear of roads belonging to outside authorities, the Speaker's counsel has informed the Parliamentary agents that a general principle would have to be laid down. The bills would all have to be considered by the same committee, and must be ready for grouping in the second week in April.

Railless Traction Proposals in the Province of Buenos Ayres.—The Minister of Public Works of the province of Buenos Ayres has signed the decree granting a concession for a system of trolley omnibuses in Mar del Plata, to Mr. F. Gomez Molina, the plans to be presented within four months, and work commenced within four months of approval of same, failing which the concession will be cancelled. The work is to be finished within two years. Concessions have also been granted to the same person for similar services in La Plata, Tandil, Azul, Necochea, Avellaneda, Almirante Brown, Lomas, Chivilcoy, San Nicolàs, Pergamino, Bahia Blanca, Dolores, Mercedes, Tigre, and San Fernando. In all these concessions three per cent. of the gross revenue is to be handed to the Government for the first 20 years, after which time this tax will be raised to 6 per cent.

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LONDON OMNIBUS SERVICES.

An Analysis of L.G.O. and Other Returns for Six Months Ending December 31, 1912.

By Wm. Yorath Lewis.

Since the delivery of my paper on the "'Bus v. Tram Controversy" before the Society of Engineers, on February 3, the half-yearly reports of the London General Omnibus and the Underground Railway Companies have been issued. These for the first time publish returns of gross receipts and passengers carried, together with certain details of operating costs relating to L.G.O. omnibuses. The returns for the 'bus services operated by the Metropolitan, New Century, Tilling, and National Omnibus Companies, however, still remain undisclosed.

It may be of interest to analyse the L.G.O. results for the period of 184 days from June 30 to December 31, 1912, and to compare them with the forecasts given for this year's working set forth in the tables of the above paper. On the basis of these returns sufficiently accurate approximations can be made to enable the aggregate results for all 'buses to be compared also with the indications given in the paper.

According to the London Traffic Branch Board of Trade report (1912) issued on February 15, dealing with 1911 returns and certain records up to Midsummer, 1912, the number of 'buses owned in July are given below, together with the number owned at the end of the year, derived from other sources:

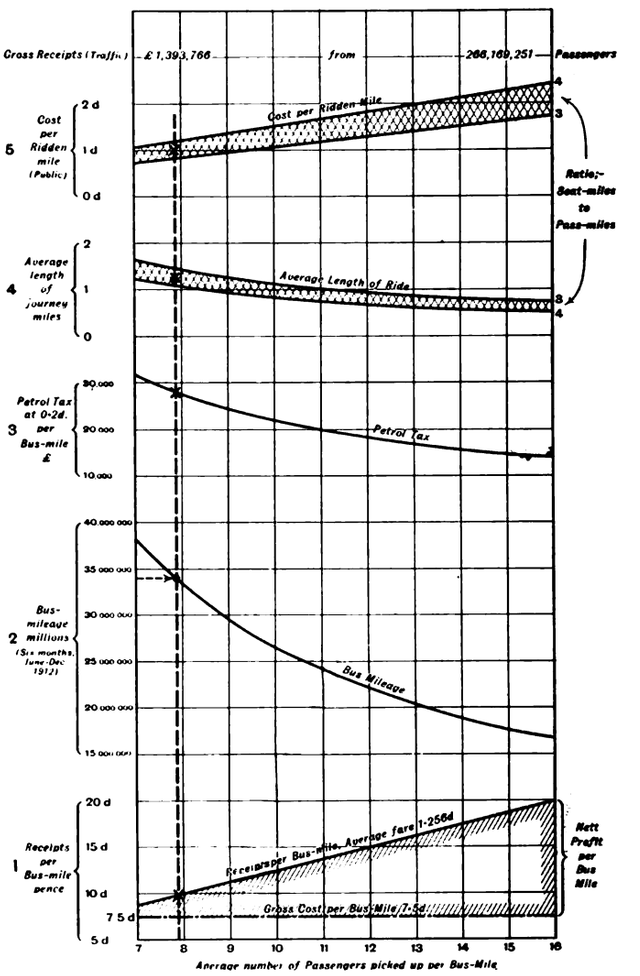
L.G.O. Co.,	1,863	in July, 1912;	2,250	at December 31, 1912.	
M.S.O. Co.,	65	"			
N.C.O. Co.,	46	"	500	"	"
T.T.O. Co.,	45	"			
N.S.C. Co.,	65	"			
Total	2,084		2,750		

The L.G.O. increase of 387 'buses was at the rate of 15 per week. The above report states that the output of this company's factory was 22 'buses per week. Thus it appears that either the older type of 'bus was being replaced at the rate of 7 per week—(a circumstance which may help to explain the exceptionally heavy maintenance charges set forth in the L.G.O. accounts)—or that the fleets of their associated concerns were being augmented at this rate.

According to the Underground Companies' report, the L.G.O. 'buses carried 226,169,251 passengers from June 30 to December 31 (184 days), and the gross receipts, including advertising, private hire, and sundries, amounted to £1,467,122, or 1·323d. per passenger. Assuming that the revenue from advertising, etc., amounted to 5 per cent. of the gross, which is probably well on the high side, the traffic receipts would be £1,393,766, or 1·256d. as the average fare per passenger picked up. The average weekly receipts from traffic alone works out at £53,600, and the number of passengers per day at 1,446,572—an increase of 232,109 passengers per day over the average for the previous six months.

Neither the aggregate 'bus-mileage, nor the average number of "fares" picked up per 'bus-mile are given in the company's report, and since the Road Board cannot furnish the amount of the 50 per cent. rebate from the Custom's 3d. per gallon petrol tax, claimed by the L.G.O. Company for the period in question—which would enable one to calculate the 'bus-mileage—it is not possible to determine in this way the actual mileage run, nor the "fares" per 'bus-miles.

The accompanying diagram will indicate what the situation would be whenever either of the above items become known. In the meantime, a very close approximation to the 'bus-mileage run can be made as follows: (1) According to details of expenses for a period of 194 days from June 21 to December 31, the sum of £376,045 was expended in "drivers' and conductors' wages." These men are known to receive from 2¼d. to 2½d. per 'bus-mile and, as the aggregate doubtless contains extras and special rates for expert drivers, it would be safe to take 2½d. as the average. Thus $\left(\frac{376045 \times 240 \times 184}{2{\cdot}5 \times 194}\right)$ equals 34,000,000 'bus-miles for the period of 184 days from June 30 to December 31. (2) As a check on this it may, according to the L.T.B. report, be



safely taken that 90 per cent. of the average number of 'buses owned during the period were worked at the rate of 35,000 miles per 'bus per annum. This gives an average of 1,845 'buses in service aggregating a mileage of 32,500,000, which indicates that the above mileage of 34 million cannot be much on the low side; 1,940 'buses worked at the above rate would give 34,000,000 'bus-miles.

On the diagram a dotted line has been drawn corresponding to a 'bus-mileage of 34 million. This reveals from curve No. 1: Average number of passengers picked up per 'bus-mile, 7·83; receipts per 'bus-mile, 9·83d.; net profit per average 'bus-mile, 2·33d. It will be seen

Analysis of L.G.O. and Other Motor Omnibus Services for Six Months Ending December 31, 1912.

Concerns.	June 30—Dec. 31, 1912. Period, 184 days. Traffic Receipts.	Passengers carried.	Average No. of 'Buses in Service at 35,000 Miles per 'Bus per An. and 'Bus Mileage.	Distance.	No. of Fares per 'Bus-Mile.	Average Fare.	Receipts per B.M.	Rates per Ridden Mile.	Average Length of Journey.	Pass. Miles per B.M.	Rates S.M. to P.M.	Gross Cost per B.M.	Profits per B.M.
						d.	d.					d.	d.
L.G.O. actual returns.	£1,393,766	266,169,251	1,940 34 million 'bus-miles.	10	7·83	1·256	9·83	1·01	1·24	9·7	3·5	7·5	2·33
4 others, viz., T.T., N.S.C., N.C., M.O. estimated returns	£325,000	60,000,000	360 6 million 'bus-miles.	10	10	1·30	13·0	1·26	0·97	10·32	3·3	7·5	5·5
Totals and average—all services.	£1,718,766	326,169,251 *	2,300 40 million 'bus-miles.	10	8·15	1·264	10·3	1·05	1·2	9·8	3·47	7·5	2·8

* This traffic is at the rate of 652,000,000 passengers per annum. Upon referring to Table V. of my paper giving forecast of results for 1913, it will be seen that they are likely to be considerably higher than that given therein, since the 'bus-mileage will undoubtedly be higher. Note also that the average fare is higher.

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from the analysis of L.G.O. accounts given above that the gross cost per 'bus-mile probably did not actually exceed the 7·5d. marked on the diagram. From curve No. 3, the petrol tax amounted to £28,000—only little more than one-third of the amount assumed to accrue in revenue from advertisements and sundry services.

From curve No. 4, the average length of journey, for all over-London, appears to have been only 1¼ miles, and from curve No. 5, the amount paid by the public per ridden mile was 1d. It is inconceivable that the ratio of seat-miles run to seat-miles occupied could have been outside the limits of three and four for all over London throughout the last six months of 1912. Unless the L.G.O. Company continue to run more 'bus-miles than are necessary, as evidently was the case during the period in question, the number of passengers picked up per 'bus-mile will increase, giving results readily indicated by the diagrams. Thus there is a likelihood of the L.G.O. 1913 results surpassing those of Table V., and closely approximating those of Table VI. "A" or "B" given in my paper.

In order to analyse the whole of the 'bus services for the last six months of 1912, the returns for the four other companies must be deduced from those of the L.G.O. These companies operated an average of 360 'buses during the period, giving on the same basis as taken above an aggregate 'bus-mileage of 6,000,000. Since the routes traversed by these 'buses were undoubtedly very much more lucrative than the average of the L.G.O. over all London, it would be quite reasonable to assume the average fare at 1·3d., and the average number of passengers picked up per 'bus-mile at 10. Thus the gross receipts from traffic would be £325,000, or £12,350 per week, for a weekly 'bus-mileage of, say, 228,000, carrying an aggregate of 60,000,000 passengers during the period of 184 days.

The table on the previous page brings together the analysed results of all the 'bus-services in London during the last six months of 1912 (184 days).

Turning to the details of operating expenses given in the report, these are made up as follows, when worked out on the basis of 35,000 miles per 'bus per annum, assuming that on the average there were 1,946 'buses in service, aggregating 34,000,000 'bus-miles :

	Per 'bus-mile.	
(1) TRAFFIC EXPENSES.		
Wages of drivers and conductors ..	2·5	
Road expenses, including licences, supervision, tickets, lighting, fuel, lubrication, compensation, and law charges in connection therewith, and garage expenses	2·39	
		4·89
(2) MAINTENANCE.		
Rolling stock, tyres, etc.	*3·64	
Premises, furniture, and fixtures.. ..	·13	
		3·77
(3) GENERAL EXPENSES.		
Rents, rates, taxes, directors' fees, office expenses, stationery, advertising, and insurances..		0·47
(4) DEPRECIATION.		
Leases	0·047	
Plant, machinery, furniture, etc... ..	0·013	
Motor omnibuses, etc.	0·57	
		0·63
Gross cost per 'bus-mile	Pence	9·76

The first item, "Traffic expenses," appears to be reasonable—so also do the third and fourth items covering general expenses and depreciation. The second item, * "Maintenance," however, is obviously shrouded in mystery. It is well known that tyres cost less than one penny per 'bus-mile. It is also known that the maintenance charges for rolling stock do not really exceed 0·5d. per mile, in all say 1½d. per 'bus-mile. Thus there remains a difference of at least 2·14d. or £303,000 to be explained, but no clue is to be found in the L.G.O. accounts. Turning to the report of the Underground Company, however, it will be seen that this company entirely owns a subsidiary concern called "The Associated Equipment Company," capitalised at £500,000, which comprises the Walthamstow Works and the Metropolitan Omnibus Company. The half-yearly dividend of this enterprise amounts to £62,500, which is at the respectable rate of 25 per cent. per annum on the total capital. It is probable that the complete accounts of this concern would show the disposition of other large sums (accruing as profits on services to L.G.O.) to its funds, and to developments in the shape of new 'buses for the Metropolitan Company. Thus the actual cost per 'bus-mile should in reality be reduced by 2·14d., bringing the figure down to at most 7·61d., if not 7·5d., which, for this year, with a fleet of practically new 'buses, might in reality be fairly taken as reducible to 7·0d. per 'bus-mile. This figure compares favourably with the 6·8d. given in the appendix II. of the paper which I read at the Society of Engineers.

ELECTRIC ROAD VEHICLES IN THE SERVICE OF TRAMWAY AUTHORITIES.

Mr. Day Baker, New England manager of the General Vehicle Company, in the course of an address on "The Electric Vehicle" at a recent meeting of the New England Street Railway Club, stated that practically all the electric commercial vehicles of to-day are built upon the same general lines, with a low-hung battery, single series-wound motor, simple chain drive and steering gear. The power application is by a simple controller with large-sized copper contacts. From 60 volts to 85 volts is used on the motors.

The Philadelphia Electric Company operates a large fleet of electric vehicles, including a pole-setting wagon manned by two attendants. The wagon is equipped with a derrick at its back, and a small winch under the driver's seat hauls the pole to the proper height and drops it into the hole with great ease. The output of the machine is highly satisfactory. In Boston the Edison Electric Illuminating Company has a large fleet of electric machines. One wagon of this type is used in pumping out manholes, and two men with this outfit do the work which formerly required eight men, and do it in one-half the time.

In Boston, conduits are filled with cable by an electrically driven winch located under the driver's seat on the vehicle. The same machine that hauls the wire through the conduits can be used in setting poles. The Rio Janeiro Tramways Company, Limited, utilizes 12 electric trucks in its service, including six battery-operated tower wagons and machines for hauling wire and doing general heavy work about the city. The tower wagon is of the Trenton type, and the body and tower are mounted on a 2-ton chassis, which will carry six men in addition to the driver, with a large assortment of tools. The New York Railways Company now has three electrically-driven emergency wagons used for clearing the streets, for hauling cars around difficult corners, and for general heavy service. During the snowy season cars frequently become stalled at a difficult corner at Madison Avenue and Forty-second Street on account of the congestion of vehicles. One of these emergency wagons, rated as a 2-ton machine, will pull a horse-drawn vehicle off the track or pull a car around a corner with ease. The Third Avenue Railway Company is also using electric trucks successfully, three emergency outfits being in service at present. A 5-ton electric winch equipment is a recent addition, and a number of large trucks and smaller wagons are in use, notably in hauling cable, reels, and other supplies. Electric machines are in use at Washington and Milwaukee in connection with overhead-line construction, and recent purchasers are the Lehigh Valley Transit Company and the Public Service Railway of New Jersey.

Mr. Baker emphasised the point that within its field the electric truck and delivery wagon is a highly economical transportation agency, and pointed out that the cost of supplying it with electrical energy from a street railway plant is trifling, since the charging of batteries can be most effectually done during the small hours of the night when a large portion of the plant capacity would otherwise stand idle. Boosting charges can be given from the trolley system when desirable during the standing of the equipment on the roadside, and in this way the question of mileage per battery charge becomes comparatively unimportant. High speed is undesirable in the operation of motor vehicles through congested sections, and the speeds for which such machines are now designed are ample for practically all purposes.

The speaker also referred to the advantages of an electric motor omnibus service where the density of traffic is too light to warrant the installation of track and overhead line construction. Electric runabouts are now available for street railway officers which will travel 100 miles in five hours upon one charge of a battery, and in the near future a guarantee of 150 miles in seven hours is anticipated. The true economic field of the gasoline machine is where it can have an uninterrupted run of at least 10 miles, whereas the electric truck or commercial wagon shows its greatest economy on short runs with many stops, the absence of transmission gears and cranking being important features.

In reply to questions, Mr. Baker said the mileage obtainable with a battery-driven Trenton wagon depends upon the number and size of the cells used, as well as upon the speed, but in general, running the wagon at 12 miles per hour, about 40 or 45 miles can be secured per charge of the battery. It is seldom that a Trenton tower wagon has to travel a distance that will use up such a mileage. The average run of the emergency wagon of the Third Avenue Railway is four miles. Most commercial machines are equipped with solid tyres. A 3 cent rate per kilowatt-hour on central station service compares with gasoline at 7·8 cents per gallon. Notable improvements have been made in the storage battery within the last few years, and the life records now being indicated are much better than was possible until within two or three years. With the newer forms of plates there is no reasonable objection to the practice of boosting batteries. Charging at a low rate is preferable. Mr. Frank J. Stone, Electric Storage Battery Company, Boston, brought out the point that in charging the ironclad exide cell recent tests show that as high a current input as possible without producing gassing may safely be utilised.

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TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

Annual Meeting and Dinner.

The sixteenth annual general meeting of the Association was held at the Trocadero Restaurant on February 27, 1913, the Hon. Arthur Stanley, M.P., presiding.

Mr. A. de Turckheim (secretary) having read the notice convening the meeting and submitted the accounts for the year ending December 31, 1912,

The Chairman said that the revenue from subscriptions amounted to £734 against £705 for 1912. It was very satisfactory to see the steady growth in subscriptions since the reconstruction in 1905. They would remember that their last annual Congress was held at Swansea, where the Association was the guest of the British Electrical Federation and the Swansea Tramways Company, who treated them with magnificent hospitality. The conference there proved exceedingly interesting and agreeable, and the papers read were exceptionally good and interesting. They had been invited to hold this year's Congress at Blackpool, where the very novel situation would arise that they would be the guests both of a Corporation and of two companies. The outstanding feature of the year for tramway men had been the passing of the Government's Light Railway Act, 1912. Now, although they did not get perhaps all they asked for, he thought they would agree that their thanks were due to the Board of Trade for their honest endeavour to pass a measure which was designed to simplify procedure, and which had several valuable features in it. When the bill was introduced by the Government there was in it a clause (No. 2) relating to trackless trolley vehicles, which they hoped would pass with some slight modification. During its passage through Committee, however, some amendments to clause 2 were inserted against the wishes of the Board of Trade, and these completely destroyed the value of the clause. Had the clause, as amended, become part of the bill, trackless trolley promotions would practically have ceased. With the assistance of the Municipal Tramways Association they made representations to Mr. J. M. Robertson, and he met them by agreeing to delete clause 2 from the bill. Promotions for trackless trolley schemes must therefore proceeed by bill, as before, instead of being promoted as light railways. In regard to the rating appeal (three-quarters exemptions of the general district rate), they had received notice from their opponents that they intended to carry the case to the House of Lords, and they must therefore await the final decision of that court. They had known that it would probably go to the House of Lords, and all their financial preparations were made with that in view. During the summer they were very busy with the Umpire in connection with the National Insurance Act (Unemployed Section), and on the whole they were well satisfied with the results they were able to achieve for tramway undertakings. They had also had negotiations with the General Post Office in regard to the important question of guard wires, and they hoped to arrive at some satisfactory result. A special committee was actively engaged in the preparation of a set of "Standard Rules for Motormen and Conductors": they had had a great number of meetings, and they hoped before very long to submit their proposals for approval to the members of the Association. Matters such as track maintenance and assessment for income tax are also occupying the attention of special committees. As usual, at these annual meetings it was always a subject of regret that one-third of the Council had to retire by rotation, and as always happened they lost some very valuable men. Thus they were losing Mr. Geo. Balfour, one of the most energetic pioneers of joint tramway and power undertakings; Mr. W. E. Ireland, of the L.C.C., who had given them so much assistance on some of their special committees; Mr. A. H. Stanley, whom they hoped was not entirely lost to the tramway cause; Mr. R. S. Tresilian, their old friend from Ireland, whom he hoped they would welcome again very soon; Mr. P. D. Tuckett, who, as one of the representatives of the British Electrical Federation, had given them much valuable assistance; and Mr. W. Wyld, one of their earliest and very loyal municipal friends, who also worked hard on their committees. The new members recommended by the Council for election were:

Mr. C. Shireff Hilton.

Mr. T. B. Goodyer, general manager, Croydon Corporation Tramways.

Mr. Dugdale, general manager, Oldham Corporation Tramways.

Mr. H. L. Williams, chief engineer of Messrs. Balfour, Beatty, and Company, Limited.

Mr. S. E. Baker, and

Mr. John Cameron, general manager, Blackpool and Fleetwood Tramroad.

The Chairman then moved formally: "That the accounts and balance sheet for the year ended December 31, 1912, as submitted, be approved and passed."

Mr. H. England seconded the motion, which was carried.

The members nominated for the Council were then unanimously elected, and Mr. A. W. Chambers, the retiring auditor, was re-elected.

The Annual Dinner.

The Hon. A. Stanley, M.P., subsequently presided at the annual dinner, when the following gentlemen were present:

R. L. Acland	J. Dewhirst	G. Hutchinson	H. Scholey
A. B. Anderson	W. H. Dixon	W. E. Ireland	C. S. Schultz
L. M. Armfield	S. Dudman	H. J. Jack	— Scowne
J. Bailey	G. F. Duncan	A. Jackson	S. Sellon
S. E. Baker	P. E. Eachers	D. James	J. Severs
G. Balfour	E. H. Edwardes	A. Johnson	E. E. Sharp
A. N. Banister	G. T. C. Edwards	R. Johnston	W. Shearer
C. Barber	T. C. Elder	E. P. Jones	F. F. Shears
E. P. Barfield	H. England	F. W. Ketley	R. T. Simcock
E. S. Barralet	A. D. Erskine	A. S. King	H. F. Simons
H. H. Bathurst	— Fawdry	E. C. Laughton	H. Skipworth
B. G. Battson	A. R. Fearnley	W. le Marechal	G. R. Smith
D. Batty	E. L. C. Feilden	C. Lonsdale	J. J. Smith
A. H. Beatty	A. L. C. Fell	W. L. Lorkin	W. Alderson Smith
S. Beeton	T. Fielden	H. Lotery	G. T. Somerville
H. R. Beken	E. H. Fleming	S. McCay	P. R. P. Souper
E. Benedict	F. W. Foston	T. McCubbin	H. King Spark
C. F. Bickersteth	S. F. W. Fothergill	J. W. McInnes	C. J. Spencer
C. E. S. Bill	W. E. Freir	J. B. McKinnon	Hon. A. Stanley, M.P.
H. E. Blain	O. Fry	J. McLeod	C. D. Stanley
F. Bland	N. R. Gardner	W. L. Madgen	H. P. Stokes
P. J. Boucher	F. E. Gatehouse	E. W. Marnock	W. H. Stradling
F. E. Bourne	G. Gorish	W. F. Marwood	R. Stutz
E. Boys	Sir Alex. Gibbons	A. V. Mason	A. J. Talbot
T. W. Bridges	J. J. Gibbons	H. T. Maynard	A. Tanner
W. M. Bright	O. T. Gibbs	R. Mayne	C. G. Tegetmeier
J. Bromley	A. I. Graham	C. Morgan	W. Thom
R. P. Brousson	W. A. Green	— Morrison	Coun. R. Thomson
Alderman Brown	W. L. Green	E. M. Munro	W. E. Thorne
A. G. Brown	C. Gregory	W. Murray	J. B. Tippetts
P. B. Brown	Graham Gribble	W. G. Murrin	A. Toms
H. Browne	E. P. Grove	E. R. Myers	T. H. Townell
J. K. Bruce	A. F. Hall	Leo Myers	R. S. Tresilian
N. D. R. Bruce	J. B. Hamilton	F. Napier	H. J. Troughton
C. Burchell	W. E. Hammond	E. A. Nash	W. H. Turner
C. D. Burnet	H. C. Harrington	— New	P. S. Turner
Colonel Burton	F. Crookes Harris	A. Norton	A. S. Valentine
N. B. Buxton	H. Harris	A. J. Panton	H. Vorley
J. T. Callaghan	E. A. Harrison	W. B. Pickering	C. E. Waite
S. H. Callow	H. Harvey	Dr. F. H. Pickin	A. H. Walton
J. Cameron	L. C. Harvey	L. E. Pickin	C. Walsh
J. McI. Cater	E. Hatton	P. S. Pitt	J. C. Ward
L. A. Cateaux	H. Hawley	Major J. W. Pringle	F. E. Warlow
A. W. Chambers	W. H. Hawley	G. Julyan Polglase	F. W. Warner
A. Clare	A. J. Hedgcock	J. A. Rankin	W. Watley
F. Coates	Colonel Hellard	D. W. Ratcliff	V. Watlington
E. H. Cockshott	J. Hemmings	W. Reading	H. T. Whigham
H. P. Conibear	F. Forbes Higginson	H. T. Rice	H. L. White
R. J. Cooke	C. W. Hill	J. Rodgers	H. R. White
F. Coutts	C. Shirreff Hilton	J. W. Rook	A. G. Whyte
A. Coveney	T. B. Holliday	F. R. C. Rouse	A. M. Willcox
S. Crosby-Jones	A. J. Hollington	W. M. Rumball	C. H. Williams
J. A. Cross	T. N. Hooper	J. Russ	Owen Williams
C. H. Dade	J. Herring	W. Rutherford	McKenzie Wilmot
E. E. Daglish	W. Hopkins	E. T. Ruthven-Murray	N. J. Wilson
C. Dale	J. Housman	E. J. Saunders	I. E. Winslow
R. A. Dawbarn	H. M. Howard	F. E. Saunders	W. S. Wreathall
A. de Turckheim	R. J. Howley	W. Sayer	W. Wyld
J. Devonshire	C. C. Hutchinson, K.C.	F. Schofield	Sir H. A. Yorke, K.C.B.

The toasts of "His Majesty the King," "Her Majesty the Queen, Queen Alexandra, the Prince of Wales, and the Royal Family," was proposed by the Chairman and loyally received.

Mr. Stephen Sellon: I have the honour of proposing a toast to-night which will show that the Association joins with me in giving a hearty welcome to our guests. Our guests to-night are numerous, and they have responded to our invitations in a manner we are very proud of, because the gathering together of a number of men at a time when Parliament is not meeting must mean a great amount of inconvenience to most of those who have favoured us with their presence this evening. I have, however, unfortunately to regret the absence of Mr. Sydney Buxton, the President of the Board of Trade, who, in view of his many engagements, was unable to be with us this evening. Through the illness of Mr. J. M. Robertson we are also unable to have the pleasure of his society this evening. I am very sorry that we have not these two gentlemen with us to-night, not only because we are always desirous of receiving guests, but because we are desirous of giving our personal thanks to Mr. Buxton and Mr. Robertson for the great service they have done the tramway enterprise by helping into being a few amendments to the Light Railways Bill, which had made that bill workable instead of leaving it, as it otherwise would have been, more or less unworkable. Incidentally it may be worth while mentioning that through their powerful influence they have been able at the request of the Tramways and Light Railways Association to enable the ordinary promoter to vary the Lands Clauses Act by which we are able to modify clause 92, and thus take only a part of a property instead of the whole of it. Those who are familiar with tramway enterprises will understand what a very great concession that is to us. Then, again, we have a very excellent amendment which means that our friends the railway companies can no longer hold a pistol at our heads as in times of yore. Dozens and dozens of tramway schemes or light railway enterprises to my knowledge have been lost and have never been re-promoted which would have been carried out had it not been for the opposition of the railway companies, who could, under a particular section of the Light Railways Act, say, "It shall not be

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carried out." There was no appeal. Mr. Buxton and Mr. Robertson have been enabled to bring in a modification of the Light Railways Act by which we can now go to Parliament, and it will be for them to throw out an enterprise of this description. Then we have a very important addition, which is that we have a general arbitration clause in which the Light Railway Commissioners are the arbitrators. I need hardly say what an advantage this is, for we all know that instead of going to one arbitrator and another arbitrator, who have never heard of such a case before, we shall be able to go before the Light Railway Commissioners, who will be the arbitrators of their own particular clauses and know what the effect is and what they meant in saying that these particular clauses were passed. And last, we come to the fact that we can congratulate the Light Railway Commissioners that they have now a five years' tenure instead of the yearly tenancy under the Expiring Laws Continuation Bill. It may be that this five years' tenure will strengthen their hands and will enable them to feel that they are not quite dependent on the will of a few people who may say that their particular verdicts here and there are not quite in accord with what is desired. We have to-night with us Lieut.-Col. Sir Arthur Yorke. If I may be allowed to call him an old personal friend, I need hardly say that I look back with pleasure on the many years that I have been associated with him. I have always known him to hold the position of keeping the scales of justice well balanced between different interests. We congratulate Sir Arthur Yorke on the title which has been bestowed on him, and we say, as a Tramways Association, that no man is more deserving of it—(applause)—and we can only regret the fact, which I have heard from his own lips, that the time may be when we shall not have the pleasure of having him at our call to assist us in the position he occupies, and in which position he has shown himself a wise judge. Then we have Colonel Hellerd, of the Board of Trade, who does a great deal in connection with the traffic reports of the Board. We have also Major Pringle, and I would also say that the Light Railways Act is largely due to the assistance and energy of Mr. Marwood. We have also with us to-night one or two members of the Municipal Tramways Association—members who hold a proud position with the Association. We have Mr. Fearnley, the president of the Association; Mr. Spencer, the secretary, and we have another gentleman, whom we all know so well, Mr. Blain, who has that happy knack of dealing with large assemblies which we noticed at the last Conference. If any man can keep in order the Tramways Association, he must be a very clever man—that is Mr. Blain. We have also with us Mr. Erskine, the secretary of the Light Railways Commission. I have always felt that the Light Railways Commission was a body constituted to do great work in the country. It has done a considerable amount of work, but it has always been hampered by restrictions, which, by the aid of Mr. Buxton, we have now got rid of, and I hope Mr. Erskine will convey to the Light Railway Commissioners our hope that now they are freed they will let us show what we can do to provide the best means of communication, which we have been prevented from doing in the past by the particular difficulties which have been placed in their way. And now, finally, I have another pleasant task, which is to mention the names of Mr. Tegetmeier, Mr. Shireff Hilton, Mr. Madgen, Mr. Somerville, and Mr. Dade. Unfortunately, I was assisting the industry in a profitable manner by helping the Edinburgh Corporation in an accident case or two, whilst the members of the Association were enjoying themselves at Swansea. I regret that I was not free. (Hear, hear.) At any rate, I am speaking with the knowledge that has been given to me by those who were there, when I say that never did gentlemen lay themselves out more openly to amuse their guests than did the gentlemen I have mentioned at Swansea. Mr. David James, who holds the position of secretary and general manager of the company, was untiring in his efforts to give everyone concerned a most pleasant and agreeable holiday. At these visits to the areas of various companies and various undertakings we meet with so much hospitality and generosity that it is difficult for us to give full credit. At any rate, I hope they will take it from me that, speaking on behalf of the Association, we thank them most heartily. I can say, as one of the oldest members of the Association, and with the Association at the back of me, that we heartily welcome the guests here this evening. We hope they have thoroughly enjoyed themselves. I ask you to drink the health of our guests, with which I couple the name of Sir Arthur Yorke.

Lieut.-Colonel Sir Arthur Yorke: It is in no conventional sense that I say the honour you have conferred upon me to-night is almost more than I can carry. It is as sudden as it is great. I had no idea that I should be called upon to address this great assembly of tramway men, and I feel I have come ill-prepared for the purpose. The honour is all the greater in that I have to represent so many distinguished gentlemen who are gathered round these tables as your guests, and also those other gentlemen who would have been here if they could, and who no doubt are here in the spirit if not in the flesh. To represent so many persons of eminence is a task which I fear I am hardly equal to, and I feel rather like the frog in the fable. In aspiring to represent so many eminent men, I rather fear I shall come to an untimely end. (Laughter.) Mr. Sellon has mentioned the spirit of hospitality which pervades the Tramways and Light Railways Association, and I am proud and pleased to be able to bear testimony to that hospitality which for the last 20 years I have enjoyed from time to time in various parts of the country when it has been my duty, and also my pleasure, to visit the undertakings belonging to the various representatives now present. It has been one of the greatest pleasures of my life to be associated with tramway engineers and managers, as well as with railway people in this country. The work which we at the Board of Trade have to do would be difficult in the extreme if it were not for the goodwill and friendship with which we are invariably received on all sides by those with whom we come in contact. As Mr. Sellon has reminded you, I have been associated with tramway enterprise for the last 20 odd years, and I can look back to the old days of the old horse tramways which pottered along on a track which was more holes than rails—(laughter)—and I also remember the steam trams, which were perfect juggernauts in the streets of Birmingham and other cities, and in Yorkshire. When you remember all this and look at the present development of the tramway enterprise, and see the magnificent cars running in the streets of all our big cities, you have every cause to be proud of yourselves, and all you have done. It is a source of immense pride to me personally to have been in some small outside way associated with the development. I have travelled to a certain extent on the Continent, and in America and Canada, and I have looked at the tramways in many of the cities in those countries, and I say without hesitation that there is no country in the world and no city in the world which has tramways equal to those in Great Britain. (Applause.) We hear a good deal from time to time of Americanising our English railways, but I have never heard anyone suggest we should Americanise our English tramways. It would not be right for me to take all that Mr. Sellon has said actually to the letter, but I will accept it in the spirit he has shown, and I will accept it on behalf, not only of myself, but of my colleagues at the Board of Trade. It is only on that account that I feel in any way these eulogies are deserved. So far as we are able we do our best, and no one can do more. On behalf of the guests who are assembled round this table, I thank you most heartily.

Mr. A. R. Fearnley (president of the Municipal Tramways Association): I am honoured in having the duty allotted to me of proposing this toast, but, in doing so I realise that amongst your guests there are a considerable number of distinguished gentlemen to whom the duty might better have been entrusted. I, therefore, approach my task with considerable diffidence. I realise, however, that it is a pleasure to be associated with an association or associations, which are in such a flourishing condition as the Tramways and Light Railways Association, and also the Municipal Tramways Association, with which I have the honour to be connected. No doubt the majority of us (whether actual tramway operators or connected with supplies for traction purposes) are experiencing a very flourishing condition of things in our business. I think we may fairly claim that this year will, if present prospects are to be relied upon, beat all previous records for passengers carried, gross receipts, or work turned out. During the year municipal men have had the pleasure of co-operating with you on some important matters, for instance, the attempt to amend and widen the scope of the Light Railways Act, which has been so happily referred to by our friend Mr. Sellon. We were in hopes, in connection with that Act, that in addition to the important things Mr. Sellon has referred to, we should get a clause empowering us by application to the Light Railway Commissioners to get authority to work trackless trolley cars. Unfortunately, through no fault of our good friends at the Board of Trade, we were not successful. We further had the pleasure of working on a joint deputation to the Post Office to meet our quondam friends, who have, or who should have, charge of all telegraph and telephone wires, and I trust the result will be a very great reduction in those hateful things which are commonly called guard wires. I can speak very feelingly on the matter, because I happened be one unhappy man who had experienced the pleasure of a guard wire coming down and doing a certain amount of damage. We hope that we shall get all these wires underground, or at all events insulated. On all these matters our co-operation has been in the best interests of the industry which we have the honour to represent, and no doubt, if I may anticipate matters a little, I may say we may shortly find it necessary again to co-operate in meeting the gentlemen who have charge of road maintenance, and who, amongst other things, are experts on water-bound macadam roads, and who are constantly asking us to come along and share with them the expense of maintaining these hateful things. Then again, there is the common enemy, the Tramways Act, 1870, on which some of your members hold strong opinions, and no doubt the majority of whom have seen reference to, and agreed with, that chapter of Mr. Balfour-Murphy's recent publication. One paragraph is worth repeating, and it is where he says: "The cost of obtaining bills for the development of the country in the way of railways, tramways, electric power-stations, or other matters is so enormous that the nation suffers grievous harm, and burdens are placed on it unnecessarily which must be borne for all time." The only point in regard to this matter is who is to lead the attack, and I suggest it is a matter to which the Tramways and Light Railways Association might give serious consideration. Whether as an Association you can speak in satisfactory terms of the progress of electric traction during the past year is a rather difficult matter to decide. I am afraid that one or two of your companies are being taken over by municipalities, and perhaps

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one or two others may follow. It was stated the other day that during the year two systems had changed the control from company to municipality, and two others are seriously considering the matter. Whether our worthy and esteemed chairman, Mr. Stanley, will consider this as a further extension of the tentacles of the "Octopus," or will call it by some other name, I do not know. (Laughter). It is rather curious to notice the difference in the tendency in dealing with tramways and in dealing with power supplies and electric light. The tendency with electric light seems to be for the smaller municipalities to hand over their undertakings to companies, whilst the tendency with tramways seems to be the other way. I am somewhat curious to know whether you have yet considered the question of widening the title, scope, and interests of your Association, to include those systems which do not run in any "silly groove." Who is to look after the interests of the undertakings which are being formed to run the trackless trolley cars and motor 'buses? This year promises to be a busy one in Parliament in respect of applications to work the trackless trolley and motor 'bus systems, and I am glad to note that the majority of these applications come from existing tramway operators. I noticed in THE TRAMWAY AND RAILWAY WORLD that the total capital expenditure proposed was estimated at somewhere over £1,500,000, so that there is a good deal of work to be done in traction matters during the next few years. In this way I see no reason why we should not extend our policy and powers so as to include both trackless trolley and motor 'bus in our systems, and use them to the fullest extent. Why should these be left to rivals or competitors? Why should we not go in for these systems, test them to the rock-bottom as we have done with tramway traction, and having decided which is best for our purpose make the fullest use of them for ourselves and, if it is necessary, widen the title and scope of the two Associations so as to include these systems? There is no doubt that in the Associations we have the men who can best do this work. Last year, as Mr. Sellon has said, you had an exceedingly successful conference at Swansea, and so far as I am aware your member, Mr. Pott, is the only gentleman who has yet had courage to clearly state in cold print what are the respective values of tramways, trackless cars, and motor 'buses in a comparative form. In view of further information and experience gained, this subject is worthy of further attention, and I trust that, providing the corner in petrol does not put the 'bus out of the running, we shall again have useful discussion on the matter. I am not quite sure which side of the fence the majority of the members of your Association are on in regard to the chairman's "Octobus," the trolley cars, but I have no doubt that finally you will take them both in. There are one or two matters looming large on the horizon at present. There is the Traffic Board, which everybody wants and nobody will give. (Laughter.) There is the Committee enquiring into the total accidents due to power-propelled vehicles in the London streets, and whose decision will be satisfactory at least to one of the parties concerned—(laughter)—and in the provinces there is the traffic problem of Manchester—a most interesting and diagrammatic report on which I received from my friend, Mr. McElroy, yesterday. With these and other matters to interest your Association there is no fear of a lack of work to keep you fully employed, or any difficulty in finding room for the unbounded energy of your worthy, indefatigable, and dexterous secretary (Mr. de Turckheim), who appears to look more cheerful and younger as he goes along. (Laughter.) I hope that we shall all benefit to the utmost by the happy condition of trade around us, and on behalf of my colleague, the Hon. Secretary of the Municipal Tramways Association, and myself I thank you most heartily for the hospitality you have extended to us, and believe I can truthfully say that I have never been in such good company outside a Government office. I have the honour of submitting to you the toast of "The Tramways and Light Railways Association," coupled with the name of the Right Hon. Arthur Stanley, M.P., your chairman.

The CHAIRMAN: There is one advantage amongst the many which I can see in being chairman of an Association like this, in that you can always put yourself at the end of the programme, and therefore you have the satisfaction of knowing that everybody in front of you has said not what you were going to say, but what you can say you were going to say. (Laughter.) Therefore I am in this comfortable position. Mr. Fearnley has alluded in the most generous terms to all the work this Association has done, and especially, if I may say so (and I say it with great pleasure), the work which we have been enabled to do with the Municipal Tramways Association. There were times in our past history when I did not like Mr. Fearnley at all, but I dare say he has improved with age, or I have got mellowed. At all events, we get on very nicely indeed now, and the more nice things he says about us the better I shall like him. (Laughter.) And he has touched, as I have told you, on all our work very much better than I could. Mr. Sellon managed, on the subject of the guests, in a most dexterous manner to tell us what he thought about the bill in Parliament. You know there are some bright moments even in the life of a tramway chairman, and one of those bright moments I had not long ago when I presided as chairman of a tramway company over a meeting, and there met with a certain amount of criticism. One gentleman got up and criticised not me, but my fellow-directors and the manager, and he said, "I know a good deal about tramways. I have made rather a study of tramway matters," and he then proceeded to say that in one of the past prospectuses he had seen a letter signed by experts, headed by one Sellon. He had never heard of Sellon. (Laughter.) Of course it was an opportunity for me, and I was able to say that I need not attend to his criticism if he had not heard of Mr. Stephen Sellon as a tramway

Members and Guests of the Tramways and Light Railways Association at the Annual Dinner.

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expert. May I now deal for a moment with the more social side of the movement? In that connection I would like to express your opinion, which I know to be your very candid and sincere opinion, as it is mine, of our grateful thanks to those who did so much to make our visit to Swansea a great success, and a very abiding, pleasurable memory of all of us, and most of all to the Swansea Corporation and the Swansea Harbour Board, to Mr. Garcke, the head of the Federation, from whom the invitation came, and to Mr. Tegetmeir, for all he did for our benefit and enjoyment. I feel so warmly towards Mr. Tegetmeir that I have even been able to sit and listen patiently while he told me of the profits he is making out of his Auckland tramways, where, with about 100,000 people, he is drawing about £250,000. (Laughter.) With our tramways in Lancashire, even including Liverpool and Manchester, I cannot make anything like that amount. And last, but not least, at Swansea there was our friend David James. This year, I believe, we are going to have the pleasure of an invitation to Blackpool. I am a Lancashire man, and I know something about Blackpool. If it is towards the end of the week, I advise you to make arrangements to stay over Sunday. (Laughter.) As I said, I am touching more on the social side, and that reminds me that I heard one criticism made on the annual dinner. It was said we were inclined to be frivolous. May I say that that is exactly what we are here to be. The whole aim and object when we started these dinners, in a very cold and draughty room, was that we should get tramway men to meet together, and feel that at all events for one evening in their lives they should forget all about corrugated rails and guard wires. I cannot help thinking that to a certain extent we have succeeded in our endeavour. After all, tramway men have a lot of trouble, but there must be times when we are not thinking of our troubles and when we can unbend the bow a little. We know, apart from tramway management, that every accident which occurs in the neighbourhood of a tramway is made the vehicle for suing the tramway company. We know that any old gentleman who will get off a tramcar the wrong way and falls down, discovers any number of fatal diseases which have only really been brought into activity by the shock he receives on that occasion, and the severity of which on his system increases partly according to his lawyer and partly according to the amount which the company happens to be making during that particular year. My own personal trouble this year has not only been confined to human beings, but it has come from the animal world. I never thought that as a tramway chairman I should be forced to take an interest in the breeding of pigs. (Laughter.) But whilst one of our tramcars was careering along one of those populated districts of Lancashire where you can go for a mile without picking up a passenger a cart laden with pigs happened to come out of a turning. Of course, our tramcar hit it. We are never going to allow that our tramcars will not hit a pig. Anyone would think that the hitting of a pig was a very ordinary occurrence, but I need hardly say that, being our tramway, we picked out a prize pig. (Laughter.) That pig ran about for weeks afterwards, but it was clearly shown that we killed the pig, "and it died." (Laughter.) All I can say is that we had to pay a price which will make me look at bacon at breakfast with a shudder for the rest of my life. (Laughter.) I only mention that as a specimen of how trouble arises with tramways where you least expect it. Therefore, I say it is right that we should have occasions like this when we can put on one side all the cares which occur in the life of tramway men. If I may say so, I think this evening we really seem to have done it. I must conclude with a very pleasant subject, my yearly quarrel with our secretary (Laughter.) Every year this happens. Every year he carefully provides against it. Every year I reiterate the same promise that I will not mention his name, and every year I have equal satisfaction in doing it. You have been kind enough to drink the health of the Association. You will agree with me that the success which we have attained—and it is not a small success considering what we started from—is one almost entirely to the unfailing energy, the unfailing tact, and the unfailing courtesy of our secretary, Mr. de Turckheim. (Applause.) In his name and mine I thank you most heartily for the reception you have given us, and I hope we shall all meet here next year.

Mr. Tegetmeir: There is a very serious omission in the toast list this evening and this omission I am presumptuous enough to endeavour to fill. We have associated Mr. Stanley's name with the toast of the Tramways and Light Railways Association, but I now propose a toast and ask you to drink the health of Mr Stanley in his personal capacity as our chairman to-night. (Applause.) It is not for me to say what the Tramways and Light Railways Association has derived from Mr. Stanley's chairmanship of it. It is not for me to refer to Mr. Stanley's chairmanship at this dinner to-night. These things are well known to you, and perhaps better known to you than to me. I ask you to drink the toast of Mr. Stanley as Mr. Stanley himself. There are one or two things which have been said to-night with regard to the Swansea Tramways Company. I should like very much to take credit to myself for all the kind things which have been said of the Swansea Tramways Company in connection with the Congress of last year, but Mr. David James is present, and Mr. David James knows what I did towards it and he knows also what he did towards it. (Laughter.) I did offer suggestions now and then, but Mr. David James said, in reply, "Oh, you leave that to me: that will be all right." If you knew Mr. James as well as I know him, you would realise then that all the anxieties that I had with regard to the success of the Congress at Swansea were entirely removed when Mr. James told me that it would be all right. I will ask you to drink the health of the chairman, not as the chairman of the Tramways Light Railways Association, but as chairman of our meeting to-night. The Tramways and Light Railways Association appears to me to be in a position that has been described in connection with other Associations as a condition of happiness. That, we are told, is a condition in which we are striving for something that is difficult to attain, and the attainment of which is not impossible. If that is a condition of happiness I think the Tramways and Light Railways Association possesses all those attributes of a state of complete happiness. I ask you to drink the health of our chairman.

The toast was received with musical honours, which the Chairman briefly acknowledged.

BRITISH WESTINGHOUSE CLUB.

In pursuance of the welfare work carried on by the British Westinghouse Electric and Manufacturing Company among their employees, the club-house illustrated on this page was recently opened at Moss Road, Trafford Park. Under the title of the British Westinghouse Club, it is now open to all the male employees. On the ground floor there is a large hall capable of seating 300 persons, a dining room, and a spacious billiard room containing two tables. The remainder of this floor is occupied by the steward's living rooms, etc. Upstairs are the committee and retiring rooms. The basement is mainly devoted to the miniature rifle range, for which a sound-proof room has been constructed, giving a range of 25 yards and accommodation for four people to shoot at once. Outdoors there will be five tennis courts—three grass and two hard—and a bowling green. Mr. Peck, chairman of the committee, at the opening ceremony voiced the satisfaction of all present that the time had come when the difficulties of inception and organisation had been overcome, and the moment of inauguration had arrived. This had been made possible by the financial support of the directors and the members of the staff, but was mainly due to Mr. Lange, managing director, and he called upon Mr. Longworth, the architect, to present a golden key to Mr. Lange. In accepting the

British Westinghouse Club at Trafford Park.

key, Mr. Lange said it was his pleasant duty to declare the club open. The forerunner of the present club had been primarily devoted to the engineering side of the firm, and had been inaugurated as a means of transmitting to the younger employees the knowledge possessed by the older engineers. That object should always be kept in mind, and he appealed to the older members to foster the spirit of co-operation and watch over the well-being of the younger members. He expressed his appreciation to the various interests now gathered under one name, the British Westinghouse Club, such as the Social and Improvement Society, the Foreman's Association, and Apprentices' Section, who had each loyally subordinated their individual interest to the well-being of the club as a whole. He assured the ladies present of their importance in assisting in this spirit of co-operation, not only in rising at an early hour to prepare the morning meal, but in encouraging ambition in the members, and inspiring them to advance and improve their condition. Mr. Tearle, chairman of the House Committee, referred to the generosity of the directors and also to the kindness of Mr. Lange, not only in the gift of three tennis courts, but for his advice and enthusiasm. Sir W. H. Bailey offered his congratulations, and mentioned that as a director of the Trafford Park estates he was one of the first to discuss with Mr. George Westinghouse the question of the purchasing a plot of land there for the company.

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ELECTRIC RAILWAY RESULTS.

The following brief but interesting particulars regarding the last half-year's working of electric railways in London are taken from the directors' reports and from the statements made at the half-yearly meetings:

Central London Railway.

This line, like the City and South London Railway, is combining with the Underground Company's group. The receipts were £144,455, an increase of £5,902, and the expenses were £76,328, an increase of £2,632. After paying prior charges and preference dividend, dividends were declared of 3 per cent. per annum on the undivided ordinary stock, 4 per cent. per annum on the preferred stock, and 2 per cent. for the whole year on the deferred stock. The number of passengers was 18,690,033, and the ratio of expenses to receipts was 52·83. The company felt the benefit of the extension from the Bank of England to Liverpool Street, which was opened on July 28 last year. As mentioned by the chairman, Mr. H. F. Parshall, at the meeting, the whole of the permanent way is being relaid and automatic signalling is being installed. The Ealing extension of the railway will be finished next year, and by this connection with the Great Western Railway much additional traffic is expected. A bill is being promoted for an extension from Shepherd's Bush to a junction with the London and South Western Railway at Gunnersbury.

City and South London Railway.

The receipts were £83,887, a decrease of £7,163, and the expenses were £42,941, a decrease of £351. The preference dividend and a dividend of ½ per cent. per annum on the ordinary shares were paid. The number of passengers was 11,109,082, a decrease of 882,181. The decreases were mainly caused by growing motor omnibus competition. In view of the circumstances, the fusion of interests with the Underground Electric Railways Company of London has been carried out. The company are promoting a bill to empower them to enlarge their tunnels, so that through trains may be run to and from the Charing Cross and Hampstead Railway when the junction with that line is completed. Mr. C. B. Stuart Wortley, the chairman, spoke at the meeting of the serious effect of the omnibus competition and of the absolute necessity for enlarging the tunnels and providing better services. Hence the changes proposed.

Great Northern and City Railway.

The revenue was £39,040, a decrease of £1,674, and the expenses were £21,125, an increase of £156. This line never has had sufficient traffic, but great development may be expected on its acquisition by the Metropolitan Railway Company and the construction of the junctions and extensions proposed by that company.

London Electric Railway.

The total revenue was £376,710, being an increase, compared with the second half of 1911, of £10,500. The expenditure was £162,703, a decrease of £8,238, so that the net receipts of £214,007, showed an improvement of £18,758. The preference dividend was paid and one per cent. on the ordinary stock as in the corresponding half-year. Most of the increase in net revenue was swallowed up in increased prior charges owing to the issue of debenture stock to pay for the extensions now in progress. The ratio of expenses to receipts was 43·19 per cent., against 46·68, and the number of passengers was 49,190,915, an increase of 524,083. By a bill in the 1913 session of Parliament, power is being sought to make a junction between the City and South London Railway and the company's Hampstead and Highgate lines, so that through trains may be run. At the meeting on January 31, Lord George Hamilton stated that it was hoped the Paddington and Charing Cross extensions would be opened for traffic in the late summer or early autumn. The extensions would largely increase the company's traffic.

Metropolitan District Railway.

The receipts were £346,655, being an increase of £23,840 over the corresponding half of 1911. On the other hand, the expenditure of £149,109 showed a decrease of £3,546. Thus the net receipts of £197,546 were no less than £27,386 up, or more than £1,000 a week. Dividends were paid on the guaranteed, first preference, and second preference stocks, and £8,528 was carried forward. The ratio of expenses to receipts was only 43 per cent. The number of passengers was 43,092,589, an increase of 3,195,528. At the half-yearly meeting on January 31 the chairman, Lord George Hamilton, referred to various works in progress which will enable a still more frequent service of trains to be run. They include a new junction at Earl's Court, the purchase of 30 additional cars, and the provision of additional machinery in sub-stations. He explained also that there was in reality an increase of working expenses by £13,000, the apparent decrease being due to a change in the form of account necessitated by the acquisition of the Chelsea power-station.

Metropolitan Railway.

The accounts show a satisfactory increase in gross and net revenue, but a large proportion of this company's lines is worked by steam, and the electric part of the undertaking is not dealt with separately. A bill is being promoted in Parliament for the acquisition of the Great Northern and City Railway, and for making junctions in the City between that line and the company's railway at Liverpool Street, and the Waterloo and City Railway at the Bank of England. Lord Aberconway, who presided at the half-yearly meeting, mentioned that owing to improved machinery in the company's generating station the consumption of coal had been reduced by 17 per cent., though the output of electricity remained the same.

THE ELECTRIFICATION OF STEAM RAILWAYS.

In the case of several of the railways of the country references were made in the recent directors' reports and at the half-yearly meetings to the schemes of electrification which are in progress or are in contemplation.

East London Railway.

It was shown by the report that the work of electrifying this line is nearly complete. Lord Claud Hamilton stated at the meeting his hope that under electric traction a more active, progressive, and remunerative period would be entered upon. Electric energy is to be obtained from the Chelsea power-station, and 12 trains an hour will be run in each direction.

Great Northern Railway.

Lord Allerton, presiding at the half-yearly meeting, said that there was only one thing against electric traction—they might have to pay in capital expenditure more than the increased revenue would warrant. They could not work satisfactorily on the same lines a really effective electric passenger service and a goods service. They would require two lines for goods and two for passengers. Electric traction might come some day; the board had considered the matter, but that was all he could say.

London, Brighton, and South Coast Railway.

The report stated that the board have decided to proceed with the electrical equipment of the whole of the company's suburban system comprised within the area from London to Croydon and Caulsdon, and from London to Sutton and Cheam. (This scheme has already been detailed in our pages.) The work will be spread over four years. The Earl of Bessborough, presiding at the half-yearly meeting, spoke of the great advantages which have been gained from the lines already electrified. The number of trains per day in and out of the two London termini has been increased by about 50 per cent., and great increases have taken place in the number of passengers. The extension, he added, of the electrified zone is necessary to retain and develop the traffic in face of increasing tramway and motor omnibus competition. The Metropolitan Carriage, Wagon, and Finance Company will supply the new motor coaches, and Messrs. R. Blackwell and Company will carry out the overhead construction.

London, Chatham, and Dover Railway.

Sir William Hart-Dyke, the chairman, speaking at the half-yearly meeting, said that with regard to the company's loss of metropolitan traffic, it was probable that some of it might be regained by the institution of quick, bright, electric trains, but that involved heavy expenditure. In view of other large capital demands, the board would not take any steps towards electrification unless they were sure they could do so with some security that the shareholders would be benefited. The board would watch carefully the results of electrification on the East London and Brighton Railways. They had entrusted the consideration of the subject to a great expert in electrical engineering.

London and North Western Railway.

The directors' report gave a brief account of the progress of construction of the Euston to Watford electric line, and at the meeting the chairman, Sir G. H. Claughton, mentioned the estimated amount of capital expenditure for the work during the current year, namely, £600,000.

London and South Western Railway.

The scheme for electrifying this company's suburban lines, which has already been explained in our pages, was briefly mentioned in the directors' report. Mr. Hugh W. Drummond, the chairman, stated at the meeting that the board were prepared to go on with the scheme almost immediately. This refers to the first section, the other part comprising country lines down to Guildford being left over meantime. The estimated cost for the first section is £1,000,000, but the company have during the last six years lost £100,000 per annum on the lines in question. The position is to be saved by electric traction.

North Eastern Railway.

The electrical equipment was mentioned in the report of the directors of this company of a coal railway 18 miles long between Shildon and Newport (Middlesbrough). The trains will be hauled by electric locomotives and the high-tension direct-current system with overhead wire conductors will be employed. A new railway is to be built from Monkseaton to Seaton Sluice, and it also will be worked electrically. Lord Joicey, speaking at the meeting, referred to these schemes, and said that electric working had enabled the company largely to increase the passenger receipts on lines where tramway competition threatened to reduce them seriously. It had also enabled them to run a service of trains which it would have been impossible to run with steam traction.

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FINANCIAL REPORTS.

Tyneside Tramways and Tramroads Company.—The half-yearly meeting was held at Newcastle on February 11, Dr. J. T. Merz presiding. Out of a divisible balance of £4,203 a dividend of 2½ per cent. was sanctioned.

Blackpool and Fleetwood Tramroad Company.—At the half-yearly meeting on February 11, the chairman (Mr. G. Richardson) stated that the balance of profit, after providing for debenture interest, was £14,027 on receipts totalling £26,208, and the directors recommended a dividend at the rate of 7 per cent. per annum, which would absorb £6,750, and, after writing off £3,500 to depreciation reserve and £750 to general reserve, would leave a balance of £3,027. The chairman and Mr. R. H. Prestwich were re-elected to the board. The meeting thanked the general manager (Mr. John Cameron) and other officers of the company for their work during the year.

Notable Relief to the Rates at Liverpool.—The City Council on February 5 approved of rate estimates for the year which recommended a reduction in the general rate of 2d. in the pound. This was made possible by the contribution of £67,000 from the tramway profits and £30,000 from electricity profits. Alderman F. Smith and his colleagues of the Electricty and Tramways Committee have received many congratulations on this excellent result of the year's working. Considering that a conservative view of the position has been taken and ample provision was made for all requirements before the allocation was made to the rates, the citizens of Liverpool have every reason to be gratified with the management of their undertaking.

West Riding Tramways Company and Railless Traction.—Sir Herbert S. Leon, presiding at the annual meeting of the Yorkshire (West Riding) Electric Tramways Company, said the earnings from passengers were £65,707 for the past year, from parcels, £239, from advertisements £800, and from school tickets £347; and they had expended £32,556, leaving a net revenue of £34,538. They had carried 9,787,444 passengers, an increase of 147,417. Local authorities proposed to use railless cars to connect some of the villages in their districts, but this would not be in opposition to the company. The directors offered to work the system for the authorities, and pay the annual interest and sinking fund charges on the capital employed.

City of Buenos Ayres Tramways Company (1904).—At the ordinary general meeting on February 13, Mr. J. Heaton, the chairman, stated that the results for last year were even more satisfactory than those of any previous year. The annuity from the Anglo-Argentine Company of £70,660 was a fixed one, and had been duly received. The shareholders had been paid the three quarterly dividends up to September 30 last. Every year since the fusion it had been a great satisfaction to him, as chairman of the company and as a director of the Anglo-Argentine Company, to refer to the increasing revenue of the latter company. For the year 1912 that company would again show an increase of revenue, and the City of Buenos Ayres Company's annuity of £70,660 would be the first charge upon a sum, roundly speaking, of £1,000,000.

Lancashire United Tramways, Limited.—The result of the working of the several operating companies in 1912, shows: Traffic receipts £71,465, miscellaneous receipts £4,631, together £76,096. Less working expenses £47,847, general charges (including direction, management, interest, etc.) £5,356, rent of leased lines, &c., £4,961, and after including the dividend on holding in the New St. Helens and District Tramways £1,534, the profit is £19,466. The receipts, including the sale of power, compared with those of the previous year, show an increase of £1,390. Interest and dividends received from the operating companies, together with sundry receipts, amount to £13,853. After deducting interest on the prior lien debenture stock and expenses, £59 has been carried to depreciation account. The undivided surplus, after payment of interest and dividends before mentioned, is £6,905. The depreciation and renewal accounts and amounts carried forward amount to £16,429. Owing to the increased demand for electrical energy in Atherton and to the arrangements made to supply electricity in Tyldesley and other districts, it has become necessary to install a new battery and turbine.

British Material for Argentine Railway Electrification.—Mr. Sydney Gedge, who presided at the annual meeting of W. T. Henley's Telegraph Works Company on February 28, stated that during the year they had made a profit of £92,000 odd, and had spent £32,483 on additions to their buildings. The cost might very well have been spread over 25 or 30 years. They had erected new buildings for the manufacture of golf balls. Mr. George Sutton (managing director) said they had had the largest turnover in the history of the company. Their business all over the world had increased. As to the future, he could make some forecast with confidence. The current year, he felt, would turn out satisfactorily, for the company's order sheet at the present time was the largest in the history of the company for this period of the year. The directors were expecting a large accession of businesss from various projects for electrification of railways, and at the present time they had one order for nearly £100,000 for cable work in connection with the electrification of a portion of the Central Argentine Railway.

Lanarkshire Tramways Company.—The ordinary general meeting was held on February 4 at 83, Cannon Street, E.C. Mr. A. R. Monks presided, and in moving the adoption of the report and accounts, said the traffic receipts for the year showed an increase of £2,459. The receipts for the first half of the year were greatly affected by the coal strike, and but for that would have shown a further increase of about £2,500. The two matters in dispute with the County Council, namely, the utilising of money paid by the company for road widenings in building the new road known as Coronation Road, New Stevenston, and the application for Parliamentary powers for the immediate purchase of their undertaking, had been satisfactorily disposed of. No wayleave would be payable in respect of the new lines during the first two years of their operation. To meet the traffic on the extensions, the board were ordering 12 additional cars, and they were also proposing to extend their car sheds, repair shops, etc. The directors had also decided to run motor omnibuses, and services would be inaugurated in the near future. The old Motherwell skating rink had been purchased, and it would be converted into a very convenient garage for their 'buses.

Bristol Tramways and Carriage Company.—At the annual meeting on February 19 Sir George White (chairman) said the tramway receipts for the past year showed an increase of 2½ per cent., and the motor vehicle department 26 per cent. They read of outsiders airing their views as to what should be done with regard to fares, but he should like to remind them that a reduction of a farthing per passenger would sweep away every penny of profit that went to pay interest and dividend on that portion of their capital in the tramway department, and which approached 1½ millions sterling. As to the Corporation having appointed a committee to consider the question of purchase in 1915, the local authority had the option to purchase not the whole of the undertaking, but certain portions of the tramways within the city. A dividend at the rate of 4 per cent. per annum was declared. Interest had already been distributed on debenture stock and preference shares, and for the first half of the year a dividend at the rate of 4 per cent. per annum was paid.—The report showed that the gross receipts amounted to £369,614, and the working and general expenses, including renewals, to £301,412, leaving a net revenue of £68,202. This amount has been distributed as follows: Interest on debenture stock, £23,860; reserve fund, £2,593; interest on preference shares, £18,833; interim dividend at the rate of 4 per cent. per annum, £9,417; final dividend at the rate of 4 per cent. per annum, £9,416; reserve fund for contingencies and renewals, £4,083. The reserve fund now amounts to £245,372. The total number of passengers carried during the year on the company's tramway cars and motor omnibuses was 52,370,515, an increase of 2,809,514 as compared with the previous year. During the past year the directors have purchased for the sum of £1,500 the undertaking of the Clifton Rocks Railway Company, constructed at a cost of £30,000.

Dublin United Tramways Company and the Demand for Halfpenny Fares.—Mr. William M. Murphy, the chairman, presided at the meeting of the Dublin United Tramways Company on Feb. uary 4, and in the course of his review of the past half-year's work, mentioned that they had now redeemed £24,800 of mortgage bonds, which can be reissued on good terms any time that money may be required. The receipts for the half-year were less than in the corresponding six months; but 1911 witnessed the visit of the King and the fleet. By comparison with a normal year like 1910, there was an increase of £4,709. Although no addition was made to the dividend of the ordinary shareholders, the permanent way renewal and general reserve and renewal funds have been substantially augmented. In his references to the request of the Corporation for halfpenny fares, the chairman said the company were paying £15,000 a year to the local authorities in wayleaves, £12,064 in rates, and besides have to maintain the surfaces of the tracks for these authorities. A considerable revenue was, therefore, derived by the local bodies from the company, and while the shareholders had contributed £2,000,000 to create, equip, and maintain the system and to earn a dividend by no means excessive, the Corporation and the other bodies obtained a substantial dividend without any outlay. If the authorities were prepared to make a remission of the heavy charges referred to, the directors would give immediate attention to a proposal for the reduction of fares. Replying to points in the discussion, the chairman stated that the use of joint plates had prolonged the lives of the rails. If fares were reduced, they could never raise them again if they found afterwards that they were mistaken. That was the general experience. The report was adopted, and the dividends of 6 per cent. were ordered to be paid. Resolutions were adopted for amending the articles of association so as to provide for the arrangement of the accounts of the company according to the recent statutory regulations in connection with railways; to arrange that only one meeting of the shareholders shall be held in the year; and that the interim dividend on the ordinary shares shall be declared at the summer half-yearly meeting. The chairman stated that by the proposed new arrangement a good deal of expense would be saved, although it would involve a considerable addition to the clerical work.

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TRAMWAY AND OMNIBUS SHARE LIST.

Specially Compiled for "The Tramway and Railway World."

Amount Ranking for Dividend.	Shares.	Name.	Div'd. Prev. Half-year.	Div'd. Last Half-year.	Quotations, Feb. 25.	Movement During Feb. Rise.	Movement During Feb. Fall.	Latest Business Done. Price.	Latest Business Done. Date.	Yield on Buying Price. £ s. d.	Dividend Due. (Final in Italics.)	Quotations, Jan., 1908, to Feb. 25, 1913. Highest	Quotations, Jan., 1908, to Feb. 25, 1913. Lowest
640,000	5	Anglo-Argentine Tramways 5½% Cum. 1st Pref.	2/9	2/9	4⅞—5⅛	...	...	4 31/32	Feb. 25	5 7 6	Jan., Dec.	5 17/32	4½
500,000	5	Do. do. 5½% Cum. 2nd Pref.	2/9	2/9	4⅝—4⅞	...	...	94 4½	Feb. 6	5 15 9	June, *Dec.*	5 23/32	4 7/16
1,500,000£	...	Do. do. 5% Deb. Stock Red.	5%	5%	98½—100½	...	...	98½	Feb. 25	4 19 6	June, Dec.	105½	96
325,532£	Stk.	Auckland Elec. Trys. Co. 5% Mort. Deb. ...	5%	5%	101—103	...	...	103	Feb. 20	4 17 3	Jan., July.	107	101
75,000	1	Bath Electric Tramways 5% Cum. Pref. ...	6d.	6d.	11/16—13/16	...	...	14/6	Dec. 31	6 3 3	*Jan. & July*	15/16	7/16
334,696£	Stk.	Birmingham Dist. Pow. & Tract. 4½% 1st Deb....	4½%	4½%	89—91	...	...	91½	Dec. 17	4 19 0	Jan., July.	96	77
15,000	10	Blackpool and Fleetwood Tramways	4/-	9/-	13½—14½xd	...	...	13 29/32	Feb. 19	4 12 0	Feb., Aug.	14½	12
60,000	10	Bombay Elec. Supply & Trys. Co. 6% Cum. Pref.	6/-	6/-	11—11¾	...	...	11	Feb. 24	5 2 3	Feb., Aug.	12½	7⅞
1,003,614	$100	Brazil Traction...	6	6	97—99	...	— 4½	98½	Feb. 25	6 4 6	Fb.My Ag.Nv.	105½	90½
75,000	5	Brisbane Elec. Tramways Investment Co. Ord.	4/-	4/-	7½—7⅞	+ ¼	...	7 7/32	Feb. 24	5 5 0	*May*, Oct.	9½	3 3/16
75,000	5	Do. do. do. 5% Cum. Pref.	2/6	2/6	4½—5¼	...	...	5 1/16	Jan. 10	4 15 3	*May*, Nov.	5⅞	4⅞
50,000	10	Bristol Tramways and Carriage Co.	4	4	6½—7	+ ⅜	...	5½	Nov. 9/10	5 18 6	*Feb.*, Aug.	14½	5
50,000	10	Do. do. do. 4% Cum. Pref.	4	4	7¼—7¾	+ ⅛	...	7	Sept. 30	5 3 3	Jan., July.	9½	6¾
800,000£	Stk.	British Columbia Electric Railway Def. Ord. ..	8%	8%	139—143	...	— 2	141½	Feb. 25	5 12 0	May, Nov.	156	123
800,000£	Stk	Do. do. Pref. Ord.	6%	6%	119—123	...	— 1	122½	Feb. 24	4 17 9	May, Nov.	132½	105
800,000£	Stk	Do. do. 5% Cum. Perp. Pref.	5%	5%	105—108	...	...	106½	Feb. 25	4 13 3	May, Nov.	114	99
1,070,097£	Stk.	British Electric Traction Prefd. Ord.	...	...	10½—12½	...	...	11	Feb. 18	...	Apr., *Oct.*	16	10½
403,503£	Stk.	Do. do. 6% Cum. Pref. ..	6%	6%	85½—88½	...	— 1½	86½	Feb. 18	6 17 0	Feb., *Aug.*	95½	86½
1,464,245£	Stk.	Do. do. 5% Perp. Deb. ...	5%	5%	91—95	...	...	92½	Feb. 18	5 7 0	April, Oct.	101	82½
439,796£	Stk.	Do. do. 4½% 2nd Deb. Red. ...	4½%	4½%	77—81	...	...	78	Feb. 10	5 11 3	May, Nov.	84	58
246,625£	Stk.	Buenos Aires Port & City Trys. 6% 1st Mt. Deb.	6%	6%	92—96	+ 1	...	94	Feb. 20	6 6 6	Feb., Aug.	103	61
623,270£	Stk.	Buenos Ayres Lacroze Trys. Stg. 5% 1st Mt Deb.	5%	5%	97½—99½	...	...	99	Feb. 24	5 0 6	Mar., Sept.	103	89
137,610	5	Calcutta Tramways Ord.	4/6	2/6	5¾—6¼	...	...	5½	Feb. 18	5 12 0	*Apr.*, Oct.	7½	4
47,295	5	Do. 5% Cum. Pref.	2/6	2/6	4 13/16—5 1/16	...	...	4 13/16	Feb. 3	4 18 9	Jan., July	5⅞	4⅞
491,222	1	Cape Electric Tramways	1/-	for '12	⅝—¾	..	...	14/6	Feb. 4	6 13 6	Feb., *Nov.*	1 3/16	⅞
15,000	10	Carthagena and Herrerias Steam Tramways ...	5/-	Apr. '11	2¾—3½	...	...	65/	Nov. 21	...	April.	7	3
248,000	5	City of Buenos Ayres Tramways (1904) ...	2/6	2/6	5½—5¾	...	...	5⅞	Feb. 25	4 7 0	Fe My.Au No	6	5⅛
120,000£	Stk.	Colombo Elec. Rly. & Ltg. 5% 1st Mt. Deb. ...	5%	5%	93—97	...	...	96	Jan. 31	5 3 3	May, Nov.	101	87
11,500	10	Cork Electric Tramways and Lighting Co. ...	...	8/- ann.	4½—5	...	...	4 15/32	Dec. 23	8 0 0	*Mar.*	10	4½
12,327	10	Do. do. do. 5% Cum Pref.	5/-	5/-	7½—8	...	...	8	July 22	6 5 0	Jan., July	10¾	7½
3,000	10	Dublin and Lucan Elec. Railway 5% Cum. Pref.	5/-	5/-	8¾—9½	...	...	9	Aug. 25/10	5 8 3	Sep.15 Mar.15	9½	6
60,000	10	Dublin United Tramways Co. (1896), Ltd., Ord.	6/-	6/-	11—11½xd	...	...	11½	Feb. 25	5 4 6	Feb., Aug.	14	11
60,000	10	Do. do. do. 6% Cum. Pref.	6/-	6/-	11¾—12¾	...	...	12½	Feb. 25	4 14 3	*Feb.*, Aug.	14	11½
13,500	10	Gateshead & District Trys. Co. Ord.	5/-	9/-	8¾—9½	...	...	8⅞	Sept. 27	7 19 0	*Mar.*, Sept.	9½	7⅞
268,235	10/-	Hastings and District Elec. Trys Ord.	...	...	3/32—5/32	...	...	1/9	Jan. 5/12	...	...	3/16	1/32
80,000	1	Do. do. 6% Cum. Pref. ...	6%	6%	⅝—¾	...	...	12/6	June 6	8 0 0	...	⅝	15/32
125,000£	Stk.	Do. do. 4½% Deb. Stk. Red.	4½	4½	69—74	...	...	73¼	Feb. 8/12	6 1 9	April, Oct.	100	69
$9,634,000	$1,000	Havana Elec. Rly. Co. Con. Mort. 5%	5%	5%	99—103	...	...	101	Feb. 23	5 2 0	Feb., Aug.	105	80
195,000£	100	Hong Kong Tramways Co. 5% Mt. Deb. ...	5%	5%	86—90	...	...	88	Feb. 7	5 11 3	May, Nov.	92	75½
20,000	10	Imperial Tramways Ord.	Nil	Nil	4½—5½	...	...	9¼	Oct. 29/09	...	Feb., Aug.	9¾	2¼
20,000	10	Do. 6% Cum. Pref.	Nil	Nil	8—8½	...	...	6 7/32	Ju. 28/09	...	Jan., July.	9½	2¾
30,000	5	Isle of Thanet Elec.Try.& Ltg. Co.5% Cum.Pref.	2/6	Dec. '12	2⅛—2⅞	...	...	46/3	Nov. 30	4 15 3	*Mar.*, Sept.	3	¾
250,000	1	Kalgoorlie Electric Tramways	...	...	1/32—3/32	..	...	1/-	Jan. 15/12	...	*May*	3/16	1/32
170,000	1	La Plata Elec. Trys. Co. 6% Cum. Pref. ...	7½d.	Oct. '11	15/16—1	...	...	19/9	Jan. 21	...	*April*, Oct.	1 1/16	¼
30,800	10	Lanarkshire Tramways	5/6	6/-	9¾—10	...	— ⅛	10	May 27	5 15 0	Feb., Aug.	10 9/16	9⅞
250,000£	Stk.	Lancashire United Trys. 5% Prior Lien Deb....	5%	5%	78—80	...	...	81½	Nov. 28	6 5 0	Jan., July.	95	79
634,026	1	Lisbon Electric Tramways Ord.	7½d.	7½d.	1 1/16—1 5/16	+ ⅛	...	21/3	Dec. 11	4 11 6	*July.*	1 9/32	⅞
425,553	1	Do. do. 6% Cum. Pref ...	7½d.	7½d.	1 1/16—1 1/16	...	...	22/6	Feb. 15	5 1 3	Jan., July.	1¼	15/16
1,000,000£	Stk.	London General Omnibus 4½% 1st Deb.	...	4½	94—96	...	— ½	94¾	Feb. 25	4 13 9	Jan., July.	98	93½
1,000,000£	Stk.	Do. do. 5% Cum. Income ...	...	5	90—92	...	...	90½	Feb. 25	5 6 6	Feb., Aug.	94	90
125,000	10	London United Trys. (1901), Ltd., 5% Cum. Pref.	2/6	Dec. '08	4½—5	...	— ¾	5⅛	Dec. 5	...	*Jan.*, July.	8½	1⅞
63,430£	Stk.	Madras Elec. Trys. (1904) Ltd. 5% Deb. Red. ...	5%	5%	101—103	...	...	102	Feb. 1	4 17 3	Jan., July.	102	86
300,000£	100	Manaos Trys. & Ltg. Co. 5% 1st Debs.	5%	5%	87—90	...	...	88	Feb. 21	5 11 3	Jan., July.	97	86
$4,785,000	$1,000	Manila Elec. R. R. and Ltg. Corp. 5% Gld. Bds.	5%	5%	98—100	...	...	99¼	Feb. 22	5 0 0	Mar., Sept.	104⅞	84
60,000	1	Mansfield & District Trys. Ltd. 6% Cum. Pref.	7½d.	7½d.	15/32—1 1/32	...	...	19/3	Sept. 5	5 16 6	Mar., Sept.	1 1/32	¾
395,832	1	Metropolitan Electric Tramways Ord.	7	5	15/32—1 1/32	...	— 3/32	21/3	Dec. 10	5 16 3	*April*, Oct.	1⅞	⅞
78,504	1	Do. do. do. (New)... ...	...	...	15/32—1 9/32	...	...	...	...	...	...	1 9/32	29/32
500,000	1	Do. do. do. 5% Cum. Pref.	6d.	6d.	13/32—9/16	...	...	15/3	Feb. 20	5 18 6	*Feb.*, Aug.	1 1/32	11/16
$16,487,400	$100	Mexico Tramways Common Stock	$3½	$3½	106—109	...	— 3	108	Feb. 24	6 12 3	Fb.My.Au.No	151½	65
$3,840,000	...	Michigan Untd Rys. Co. 5% 1st Debs & Refdg Bds	5%	5%	93—95	...	...	93½	Feb. 22	5 8 6	May, Nov.	101½	92½
600,000£	100	Montreal Street Rly. 4½% Ster. Debs.	4½%	4½%	98—100	...	...	98½	Feb. 25	4 10 0	Fe.My.Au.No.	107	98
5,000	10	Oldham, Ashton, and Hyde Elec. Tramways Ord.	5/-	...	6¾—7	+ ⅛	...	6½	Oct. 8	...	Mar., Aug.	9¾	6⅞
5,000	10	Do. do. do. 5% Cum. Pref.	5%	5%	6½—6¾xd	...	...	6 17/32	July 8	7 14 0	Feb., Aug.	8½	6⅞
77,893	5	Para Elec. Rly. and Ltg. Co., Ord.	5/-	5/-	7⅜—7⅞	...	— ⅛	7½	Feb 24	6 7 0	May, Nov.	8	6
100,000	1	Perth (W.A.) Electric Tramways Ord.	6d.	7½d.	1 3/16—1 5/32	...	...	25/6	Nov. 8	4 2 0	*Sept.*, Nov.	26/3	¾
245,000	1	Potteries Electric Traction Ord.	7½	for '11	5/16—7/16	...	...	7/6	Dec. 2	8 0 0	April.	¾	½
245,000	1	Do. do. 5% Cum. Pref. ...	6d.	5d.	13/32—9/32	...	...	13/6	Feb. 10	6 19 3	*Feb.*, Aug.	¼	1/16
124,560	1	Provincial Tramways Ord.	8d.	10d.	11/16—15/16	...	..	16/3	Feb. 19	9 4 9	May. *Nov.*	1 1/16	13/-
10,000	10	Do. do. 6% Cum. Pref.	6/-	6/-	9⅜—9⅞	+ ⅜	...	9 9/16	Feb. 12	6 4 9	June, *Dec.*	11	9
50,000	5	Rangoon Elec. Trys. & Supply Co. 6% Cum. Pref.	3/-	3/-	5⅜—5⅞	...	...	5 13/32	Aug. 31	5 2 3	June, Dec.	6	5
100,000	$100	Sao Paulo Tramway, Light, and Power Co. ...	$5	$5	...	...	...	280	Sept. 30	...	Ja.*Ap.*Jul.Oc.	290	110
32,000	10	Shanghai Elec. Construction Co.	...	...	7½—8½	+ ¼	...	8	Nov. 28	...	May.	11½	6
330,400£	Stk.	Singapore Elec. Trys. Ltd., 5% Debs. Red. ...	5%	5%	86—90	+ 4	...	84¼	Jan. 23	5 13 9	Mar., Sept.	88	61
169,570	1	S. Metrop'n Elec. Trys. & Ltg. Co. 6% Cum. Pref.	1/2⅞	May. '12	11/16—13/16	...	...	15/9	May 16	7 7 9	Feb., Aug.	1⅛	¾
91,720£	Stk.	Southern Elec. Trys. of B.A., 1st Mt. Deb. ...	5%	5%	97—99	...	— 2	97	Dec. 18	5 1 0	Feb., Aug.	100	90
160,000£	100	Sunderland District Elec. Trys. 5% 1st Mt. Debs.	5%	5%	...	...	...	58⅞	June 1/10	...	Jan., July.	88	58⅞
471,500£	100	Toronto Rly. Co. 1st Mt. 4½%, Stg. Bonds ...	4½%	4½%	97—99	...	...	99	Nov. 8	4 11 3	Feb., Aug.	104	97
80,000	5	United Elec. Tramways of Monte Video, Ord....	4/-	3/-	5¼—5¾	...	— ¼	5 7/16	Feb. 24	6 1 9	*June*, Dec.	6½	5
90,000	5	Do. do. do. 6% Cum. Pref.	3/-	3/-	4⅞—5⅜	...	...	5 1/16	Feb. 18	5 11 9	June, Dec.	6⅞	4 7/16
500,000£	Stk.	Winnipeg Elec. Rly. Co. 4½% Perp. Cons. Debs.	4½%	4½%	100½—103½	+ ½	...	102	Feb. 20	4 8 9	Apr., Oct.	109½	100
40,977	5	Yorkshire (West Riding) Elec. Trys. Ord. ...	...	...	¼—¾	...	...	8/6	Oct. 31	...	*Mar.*	1½	⅛
46,261	5	Do. do. do. 6% Cum. Pref.	1/6	1/6	2⅞—3⅛	+ ⅛	...	65/-	Feb. 27	4 9 0	*Mar.*	3¾	1¾

ELECTRIC RAILWAY SHARES.

1,854,720£	Stk.	Central London Ord. Stock	3	3	77—79xd	...	— 2	78¾	Feb. 22	3 16 0	*Feb.*, Aug.	89½	59⅞
572,640£	Stk.	Do 4% Pref. Stock	4	4	82—84xd	...	...	84	Feb. 20	4 15 3	Feb., Aug.	92	80
572,640£	Stk.	Do. Deferred Stock	2%	for '12	77—79xd	...	— 2	77	Feb. 24	2 10 9	Feb., Aug.	91⅞	42
1,480,000£	Stk.	City and South London Cons. Ord. Stock ...	1¼	½	...	...	...	35½	Dec. 23	...	*Feb.*, Aug.	46	25½
78,000	10	Great Northern and City Pref. Ord. 4% ...	Nil	Nil	2⅜—2⅞	+ ⅜	...	40/-	Jan. 31	...	*Feb.*, Aug.	2⅞	⅛
50,000	10	Liverpool Overhead Ord.	2/-	2/6	3⅜—3¾xd	...	...	77/6	Feb. 12	6 0 0	*Feb.*, Aug.	4	⅜
1,412,263£	Stk.	Mersey Cons. Ord. Stock	Nil	Nil	5⅜—5⅞	+ ½	...	4½	Feb. 18	...	*Feb.*, Aug.	8	1
5,732,062£	Stk.	Metropolitan Cons.	1½	1¾	51¾—52¼	...	— 1¼	52	Feb. 25	3 2 3	*Feb.*, Aug.	75⅛	34
2,640,914£	Stk.	Do. Surplus Lands Stock	2¾	2¾	61—63	...	...	62	Feb. 25	4 7 6	*Feb.*, Aug.	72	61 7/16
3,235,000£	Stk.	Metropolitan District Ord.	Nil	Nil	38¼—38⅞	...	— 2¼	38⅞	Feb. 25	...	*Feb.*, Aug.	51½	9½
467,000	10	Underground Electric Railways Co. of London	...	...	4⅜—4⅞	...	— ¾	90/-	Feb. 25	..	...	5 3/16	1⅞
1,730,000£	...	Do. 4½% Bonds of 1933	4½%	4½%	98—100	...	...	98½	Feb. 22	4 10 0	Jan., July	102	73
1,192,707£	...	Do. 6% 1st Income Debs.	6%	6%	111½—113½	...	...	112¾	Feb. 25	5 7 9	Mar., Sept.	117½	110½
6,120,750£	...	Do. 6% Income Bonds	40/-	60/-	95—96	...	— ½	95¾	Feb. 25	5 7 6	Mar., Sept.	96½	18

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PERSONAL.

Mr. J. B. Hamilton has been asked by Ilkeston Council to advise them on the conduct of the tramways and electricity departments.

Mr A. B. Slater, manager of the Burton-on-Trent Corporation Tramways, has been granted an increase in salary of £25 per annum.

Mr. W. B. Cownie, who has been a director of the Torquay and Paignton Tramways Company since its formation, has been appointed managing director.

Messrs. Scholey and Company, Limited, of 151, Queen Victoria Street, London, E.C., inform us that they have ceased to represent the Electro-Mechanical Brake Company.

Mr. T. Hall, borough electrical engineer, Burton-on-Trent, has been granted an increase in salary from £225 to £275 per annum. His assistant, Mr. C. J. Melbourne, has received an advance of £15 a year.

Mr. A. A. Watkins having resigned his office as manager of the Musselburgh Electric Tramways Company, as he is leaving for the Colonies, Mr. C. W. Bentley, assistant manager, has been chosen to succeed him.

Mr. W. Smith-Saville, borough engineer of Darwen, and joint engineer-manager of the Corporation tramways, has been presented by the members of the staff with a silver rose bowl upon his retirement from the tramway management.

Mr. A. R. Fearnley, general manager, Sheffield Tramways, is recommended by the Tramways Committee for an increase of salary from £800 a year to £900 forthwith, with four subsequent annual increments of £25 to a maximum of £1,000.

Senior Inspector H. J. Smith, of the Mexboro' and Swinton Tramways Company, who has been appointed parcels superintendent to the Rhondda Valley Tramway Company, has been presented with a travelling bag and card case from the employees.

Mr. H. T. Bates, on resigning his position as resident engineer to the South Metropolitan Tramways and Lighting Company to become resident manager to Rothesay Tramways Company, has been presented with a marble clock by the staff. Mr. A. V. Mason, general manager, made the presentation.

Mr. J. P. Fox, of New York and Boston, as the result of a public subscription inaugurated by a Montreal newspaper, has been engaged to prepare a report on the tramway service in that city. As the result of a report which Mr. Fox submitted on street traction in Pittsburg, an official of the Street Railways Company states that his recommendations have tended to reduce congestion and the crowding of the cars at the rush periods.

Mr. A. de Turckheim.—At the annual Congress of the Tramways and Light Railways Association held in Swansea in June last, the secretary of the Association, Mr. A. de Turckheim, was presented with a clock. A plate has now been affixed to this clock bearing the following inscription: "Presented to A. de Turckheim by the members of the Tramways and Light Railways Association, as a token of esteem and appreciation of his organising genius. Swansea, June, 1912."

Mr. Samuel White, managing director of the Bristol Tramways and Carriage Company, was welcomed back to the annual meeting on February 19 by Mr. J. H. Howell, one of the directors, who remarked that for some time the company had lost his services through illness. Amid applause Mr. Howell added that Mr. White made a present of £10,000 in order that homes should be provided for men who were worn out in the company's service. The speaker offered Mr. White his hearty thanks, and said he was sure the meeting would endorse the sentiment.

Mr. H. P. Stokes has been entertained at dinner by members of Ilkeston Council and a number of townspeople on resigning the managership of the tramways and electricity departments to take up the appointment of manager of the Bexley Heath Council's tramways and electricity undertaking. The Mayor (Councillor Sudbury) asked Mr. Stokes to accept a silver tea urn from the members of the Corporation and other subscribers, and referred to the satisfactory condition to which the recipient had brought the two departments. At an assembly of the employees Mr. Stokes was presented with a silver cake basket.

Alderman F. A. Dunsford, chairman of Southampton Tramways Committee, has been presented by the Mayor, on behalf of the tramways staff, with an umbrella as a token of respect and appreciation of his work in the promotion of the employees' welfare. The presentation was made at the opening of the new recreation room, rifle range, and mess-room at Portswood depôt, this being the second such institution in connection with the tramways. Alderman Dunsford, in reply, referred to the gift as a symbol of the kindly feeling which existed. The staff had increased from 110 to over 400. They commenced with ten cars, and there were now 73. From the time the Corporation had taken over the service it had been an unqualified success.

Mr. Leonard C. F. Bellamy has been appointed tramways manager to Ilkeston Council. Mr. Bellamy's career began in the electrical and tramways construction departments of Messrs. Dick, Kerr and Company, under whom he took part in the construction of the Portsmouth and Rothesay tramways. Subsequently he visited America and studied the tramways of New York, Brooklyn, New Jersey, Niagara, Detroit, and Boston. Later he acted as general assistant to the manager of the Liverpool Corporation Tramways. He resigned this position to go to Burmah as assistant manager of the Rangoon Electric Tramways and Supply Company. At the end of his three years' agreement he came to England and took up the position he is now resigning as assistant manager to the St. Helen's Tramways.

Mr. J. W. Dugdale, general manager, Oldham Tramways, on February 7 was granted an increase in salary from £350 to £400, the commitee's recommendation being carried by 20 votes to 13. Councillor Isherwood, chairman of the committee, stated that those closely connected with Mr. Dugdale knew his worth. The committee had passed the resolution unanimously. Quoting salaries paid in other towns, the proposer said that if they advanced the salary £100 Mr. Dugdale would not be receiving what might be regarded as the standard rate. At present he was receiving £100 a year less than their previous manager. Mr. Dugdale had undertaken duties which previously were done by the borough surveyor. He had taken over the permanent way upkeep, greatly to the advantage of the town. The Council also passed a revised scale of wages for motormen and conductors.

Mr. J. M. M'Elroy, general manager, Manchester Corporation Tramways, on February 5, by means of diagrams thrown on a screen in the Lord Mayor's parlour, described to members of the City Council the congested state of tramway traffic in Manchester, and its probable growth during the next 20 years. Mr. M'Elroy referred to the following questions: Probable increase of tramway traffic during the next 20 years; congestion in central streets; widening of existing streets; an arterial centre; construction of subways; and the financial resources of the Tramways Committee for these purposes. At present, Mr. M'Elroy said Oxford Road and London Road routes are those mostly used. By reason of the through routes introduced by the Tramways Committee, fewer cars are taken along Market Street to-day than was the case under the old Manchester Carriage Company, although the number of passengers had increased enormously. He condemned the proposal to utilise the Infirmary site as a tramway centre, and considered that Mr. Guthrie's scheme for an underground tramway was of little value.

Mr. H. F. Parshall, in presiding over the half-yearly meeting of the Central London Railway on February 13, announced that he was retiring from the board to accept the position of consulting engineer to the whole of the Underground interests. During the period in which he has occupied the chair of the Central London Railway he has acted not only in the capacity of chairman to the railway, but also as managing director and consulting engineer, having in fact absolute control of the railway from every point of view. The results accomplished have been in many respects remarkable in that the operating expenses have been largely reduced and the efficiency of the railway greatly increased. Important engineering improvements have been made and the property maintained on a high standard. A system of ventilation has been adopted so that the railway has regained to a considerable extent the popularity it enjoyed during the first years of its working. The opening of the Liverpool Street extension was hastened many months. Important extensions providing connection with Ealing have been arranged, and are projected in connection with Richmond. Mr. Parshall in resigning his position as chairman and accepting the position of consulting engineer to the Underground interests as part of his general practice, is now enabled to give, as formerly, his whole time to his private consulting practice, and to give his undivided attention to the numerous railway and power projects with which he is associated.

Mr. Charles Mittelhausen, late electrical engineer and tramways manager to Bexley Urban Council, has been presented with a pair of binoculars and a clock by the members of the various departments in the municipal service. Councillor E. J. Reid, who presided, stated that as chairman of the Electricity Committee for four years, he had been in close and constant contact with the manager, and he had always found Mr. Mittelhausen the soul of courtesy and loyalty. Had it not been for the manager's energy the electricity undertaking would have been in a far different condition. He had always worked to one end, efficiency, and had not spared himself. Having in view the material he had to work upon, he was to be heartily congratulated upon the result. As an engineer, Mr. Mittelhausen stood in the very front rank, and as a man and a comrade he was held in high esteem. They were sincerely sorry that Mr. Mittelhausen was leaving them, and they wished him good luck, improved health, and success in the future. In the course of his response, Mr. Mittelhausen suitably acknowledged the gifts, and thanked his staff for their cordial co-operation and loyalty. Speaking of the electrical and tramways undertaking, he said that during the past three years there had been no call on the rates, but such conditions, he was afraid, could not be maintained. Mr. H. P. Stokes, the new manager, remarked that from his own observations during the short time he had been there he could support what the chairman had said with regard to the amount of work Mr. Mittelhausen must have done. On February 8 the employees in the lighting and tramways department presented Mr. Mittelhausen with a silver cigarette case.

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CONTRACTS AND ORDERS.

Ferranti, Limited, have received the contract for the supply of tramway car meters for Newcastle-on-Tyne.

Ilford Council have given an order for bracket arms for the tramways department to Watlington and Company.

Liverpool Corporation have placed a contract with Halley's Industrial Motors, Limited, for a chassis for a tower wagon.

Staveley Coal and Iron Company are supplying 10,000 3-in. cast-iron cable pipes, at £6 10s. a ton, to Sheffield Corporation.

Mather and Platt, Limited, have obtained a contract for the supply of filtration plant at Salford electricity works, at £635.

Salford Council have accepted the tender of W. T. Henley's Telegraph Works Company for the annual supply of trolley wire.

Heywood Tramways Committee have accepted an offer by the Tudor Accumulator Company for repairs to the accumulators.

Milnes, Voss, and Company have received an order to supply a single saloon car to the Douglas Tramways Committee at £251.

Blackpool Council have placed an order with Halley's Industrial Motors, Limited, for the supply of a petrol motor tower wagon.

R.E.T. Construction Company, London, have received an order for two more railless cars, at £765 each, from Rotherham Council.

E. Bennis and Company have received an order to supply two stokers and self-cleaning compressed-air furnaces to Barnsley Council.

Paterson Engineering Company have been allotted a contract for the supply of a water softener to Leyton electricity works.

John Brown and Company, Limited, have been given a contract for the supply of 600 steel tramcar tyres, at 26s. per tyre, to Sheffield Corporation.

W. A. Stevens, Limited, have received orders from Southport Corporation and Oldham Corporation for petrol-electric omnibuses of the Tilling-Stevens type.

Aberdeen Council have placed orders with the Oerlikon Company and Messrs. Bruce Peebles and Company for additional generating plant at a cost of £11,000.

Glasgow Railway Engineering Company, Limited, are supplying 200 cast-steel tramcar wheels and tyres, at £4 1s. 6d. each, to West Ham tramways department.

British Westinghouse Company have obtained a contract for the supply of 1,000-KW. mixed-pressure turbine set, with condensing plant, at £7,524, to Grimsby Council.

The Tudor Accumulator Company have received a renewal of the contract for the maintenance of the battery at the Govan works of Glasgow Corporation for a period of 10 years.

Manchester Tramways Committee have accepted the tender of the Bell Punch and Printing Company for the supply of passenger tickets for the three years ended March 31, 1916.

Eastbourne Council have accepted the tender of the British Westinghouse Company for the supply and erection of a 1,500-KW. turbo-alternator (without condensing plant), running at 3,000 r.p.m.

The United Electric Car Company have received an order for the supply to Burnley Corporation of ten top-covered bogie tramway cars and ten pairs of maximum traction trucks of the Burnley type.

Siemens Brothers have been awarded the contract for the electrical equipment for ten electric freight locomotives to be used on the North Eastern Railway Company's mineral line between Shildon and Newport, which is undergoing electrification.

Glasgow Council have accepted the tender of Babcock and Wilcox, Limited, for the supply of four water-tube boilers, at £13,748, and of Howden and Company for the supply of four boilers, at £6,910, and of Howden-Zoelly turbo-alternators and condensing plant, at £17,793.

London County Council have accepted the following tenders: British Insulated and Helsby Cables and Brecknell, Munro, and Rogers, fittings for the overhead system, £123 and £113 respectively; Venner's Signs, Limited, number plates for indicating routes, £3,805; Bayliss, Jones, and Bayliss, 300 tie bars and 2,000 tie rods, £152.

Ayr Council have accepted tenders for material required for tramway extension as subjoined: Blackwell and Company, trolley wire and guard wire; Welsh and Company, mechanical ears; Fleming, Birkby, Goodall, and Company, Limited, overhead fittings; Stewarts and Lloyds, Limited, poles; Bayliss, Jones, and Bayliss, Limited, 1,200 tie bars.

Babcock and Willcox, Limited, have obtained a contract to supply new boilers for the power-station of Dewsbury tramways and electricity undertaking, and a mechanical stoker to the Walsall Council. This company were also the successful tenderers for the supply and erection of steam generating equipment for an electric power-station of the New South Wales Public Works at £5,353.

Liverpool Corporation have placed contracts for plant at the Lister Drive power-station as appended: Babcock and Wilcox, six boilers with chain grate stokers, induced draught fan (with motor), gravity bucket coal conveyor and motor, overhead coal bunkers and floor for supporting economisers, flues, and fans; E. Green and Son, six economisers; J. Crawford, four induced draught fans and control panels, motors, and platform.

TRAMWAY AND LIGHT RAILWAY NOTES.

ASHTON.—Mr. Ernest Holt, general manager, Ashton-under-Lyne Corporation Tramways, has reported to the Tramways Committee that in consequence of the recent fire at the electricity works at 9 p.m. the service of cars was entirely stopped, but through the kindness of Mr. McElroy, the Manchester tramways manager, in allowing his men to make temporary connections at the Audenshaw boundary, the drivers were enabled to run the cars into the depot; and through the kindness of Mr. Blackmore, the Stalybridge Joint Board's tramways manager, in allowing his men to make temporary connections at the Park boundary, so as to feed the lines from 4 to 10 o'clock the following morning, the usual service of cars was maintained. The committee expressed high appreciation of the assistance afforded.

BELFAST.—After inspection by Major Pringle seven extensions of the city tramways were opened for traffic on January 30, the work of construction having been carried out by Dick, Kerr and Company, Limited, at £100,390. The scheme, for which Mr. A. Nance, the general manager, was responsible, includes a new depot at Ardoyne.

BOURNEMOUTH.—After a seven years' contest between the rival camps a Sunday service of cars was started on the Bournemouth Tramways on February 9.

BRADFORD.—The Bradford stipendiary magistrate has delivered judgment in a case in which a Bradford man was charged with using bad language on a Leeds car running between Leeds and Bradford, and within the Bradford boundary. The magistrate said the point was whether the tramcar, although the property of Leeds Corporation, was a carriage belonging to Bradford Corporation within the meaning of the section. In this case, although the tramcar in the agreement was said to "belong to" Leeds, yet the possession and control of the car was with the Bradford Corporation. He therefore came to the conclusion that the tramcar came within section 46 of the Act of 1870, and there would accordingly be a conviction. Defendant would be fined 2s. 6d. and costs, or seven days' imprisonment.

BRISTOL.—The City Council have appointed the following as the Special Committee to consider and report to the Council as to the desirability or otherwise of exercising the option vested in the Corporation of purchasing the tramway undertaking within the city: Sir Edward James, Sir Frank Wills, Aldermen Pearson, Sheppard, Swaish, and Lloyd, Messrs. Humphries, Gane, G. E. Davies, Dowling, Robinson, Coole, Richards, Metcalfe, and Shirley. The directors of the Bristol Tramways Company, in their report for the past year, mention that the Insurance Act has received much consideration. If the company elected to carry out the literal requirements of the Act, the employees would be placed in a much inferior position to that they had occupied under their provident society, which has been fostered by the company for many years past. The directors have, therefore, formulated a scheme for an approved society embracing only the company's employees, and this has received the hearty approval of the Insurance Commissioners. Occasion has been taken further to enlarge the benefits so that the employees are now secured such advantages as are enjoyed by few, if any, similar employments in the United Kingdom. The employees' superannuation fund, which has been wholly subscribed by the company and the directors, totals £29,115.

CROYDON.—The Tramways Committee have recommended the Corporation to extend the system from Lower Addiscombe Road to Norwood Junction. Councillor Denning, in moving the adoption of the report, said he was convinced that the extension would pay, but if there was no profit he contended that it was the Council's duty to maintain the rateable value of the district. They were hearing a good deal about motor 'buses. Tramways could be run cheaper than motor 'buses, statistics showing that the cost per car-mile for tramways was only 6d., while the lowest for the 'buses was 7d., and on some roads a shilling. The committee had a surplus of £37,000, and they only asked the Council for the liberty to spend £30,000. In the course of the discussion the opinion was expressed by several members that omnibus competition, which is already severe in Croydon, is a certainty on the proposed route. An amendment to refer the matter back to the committee was carried by the mayor's casting vote.

DOVER.—Mr. E. Carden, the tramways manager, has informed the Tramways Committee that the saving due to the reduced charges for current was estimated at £500 a year. The Mayor observed that if the committee were going to increase the tramwaymen's wages, another farthing reduction was required in the price charged the tramway department for energy.

EAST HAM.—The Council have adopted a report presented by Mr. C. Ullmann, their tramways engineer and manager, offering terms

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for the suggested leasing to East Ham of the Barking Council's tramways situate between the boundaries of East Ham and Barking and Barking and Ilford. Power is to be supplied at 1·25d. per unit. The whole of the revenue received is to be paid to Barking Council after deducting the working costs

GLASGOW.—Bailie Kirkland, convener of the Tramways Committee, in proposing the adoption of a programme of tramway extensions on January 29, referred to an extension not contained in the minute which seemed to him to be urgent. This was a relief route in the middle of the city and a relief route to the north and south side, which would mean the erection of a new bridge over the Clyde. All were aware of the great increase in the traffic in the centre of the city, and all were equally aware that the congestion there was added to largely by the tramway traffic. He was of the opinion that if the Corporation were to erect a bridge suitable for tramway traffic and approved of by the Tramways Committee, the tramways department could contribute largely, if not wholly, to the cost of such a bridge.

LONDON.—The issue of return tickets at reduced fares on the London County Council tramcars appears to have had the effect of reducing the amount of the weekly falling off in the receipts due to motor omnibus competition. The conductors' work is also lightened.

LOWESTOFT.—Lowestoft Council on February 11 discussed the appointment of a committee to inquire into the working of the tramways, to report whether the annual charge upon the rates can be reduced, and to endeavour to dispose of the undertaking on terms to be sanctioned by the Council. The committee were not appointed, the meeting breaking up amid disorder.

MANCHESTER.—The City Council, on February 5, discussed the proposal of the Tramways Committee that the general manager and the engineer should visit cities at home and abroad with a view to acquiring information which would be of service in the carrying out of the proposed tramway extensions. The matter was referred back to the committee, and their original recommendation was again submitted to the Corporation later in the month, when the chairman of the Watch Committee raised the question whether it was proposed to relegate to the Tramways Committee duties which had previously been performed by the Watch Committee. By 44 votes to 33 the Council referred the proposal back to the Tramways Committee. The Lord Mayor said that after this expression of opinion by the Council he thought that Alderman Bowes would most probably call a conference.

NORTHAMPTON.—Northampton Council have adopted schemes for an extension of their tramways to Kingsthorpe, at a cost of £15,620, and to Far Cotton at an outlay of £17,430, the latter to cross the L. and N.W. Railway by a single track. Councillor T. D. Lewis, chairman of the Tramways Committee, stated that they had considered the question of motor 'buses, but found that at Liverpool the cost of running was 9¾d. per car-mile, Hull 12½d., and Wolverhampton (motor chars-a-bancs) 7½d. One of the largest motor 'bus makers estimated 'buses would cost 8½d. per mile with petrol at 8½d. a gallon. As a matter of fact, petrol cost double that sum, and it would add at least a penny a mile to the cost. The total cost per car-mile of the tramcars in Northampton last year was 8·18d.—5·29d. running cost, 1·34d. interest on capital, and 1·53d. repayment of capital. 'Buses did not pay rates; tramways did. And, allowing for rates and the maintenance of the road, the tramways net cost was 7¾d. per car-mile. That compared with 9½d. to 12½d. per motor omnibus mile. They could look forward, he believed, to the Far Cotton trams paying their way and saving the £500 a year which the present 'buses cost the other parts of the town.

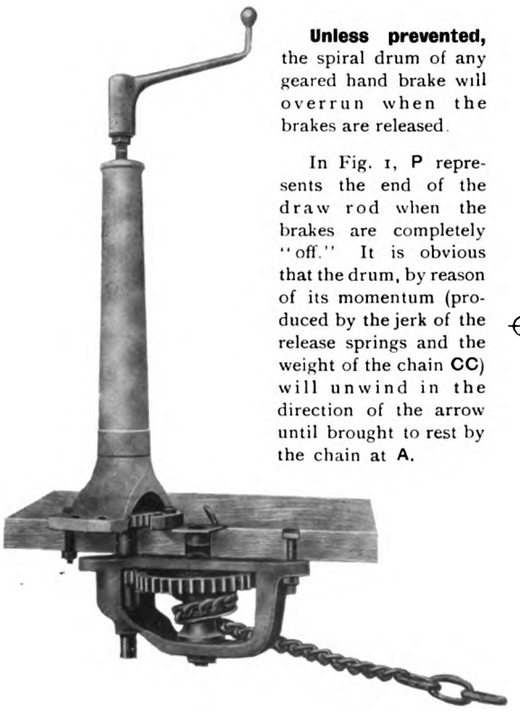
OXFORD.—The City Council have instructed the Tramways Committee to make application for the payment of the fines or penalties due to the Corporation by reason of the failure to electrify the tramway system, and to report thereon within a month. The chairman of the Tramways Committee, Colonel Waller, opposed the proposal to press for penalties on the ground that it would put a stop to negotiations, which he expects will give the city an up-to-date tramway system within 18 months. The National Electric Construction Company were, he stated, considering the advisability of introducing petrol-electric rail cars, which would run with overhead wires, except in those streets in which the overhead system was prohibited. Colonel Waller added that the gentleman who was financing the matter had taken a great interest in it. He had visited Oxford, and and been all over the system, and had been to America to negotiate about the cars. As the result of the resolution passed by the Council, the chairman and another member of the committee have resigned. Definite proposals with regard to the adoption of petrol-electric cars have since been received by the town clerk.

SOUTHAMPTON.—The tramways manager has recommended the Tramways Committee to provide meters on the cars for checking waste of current, and also to inaugurate a bonus system.

STIRLING.—The proposed improvement of the tramway system formed the subject of a report made to the Town Council on February 17, by the Tramways Committee, who expressed the opinion that the best course to follow would be to encourage a company to come forward to undertake the new system, and, further, that inquiry should be made as to the railless system of tramway traction. The clerk and the surveyor were instructed to ascertain the experience of this system in the towns where it had been instituted.

THE "PEACOCK" IMPROVED BRAKE

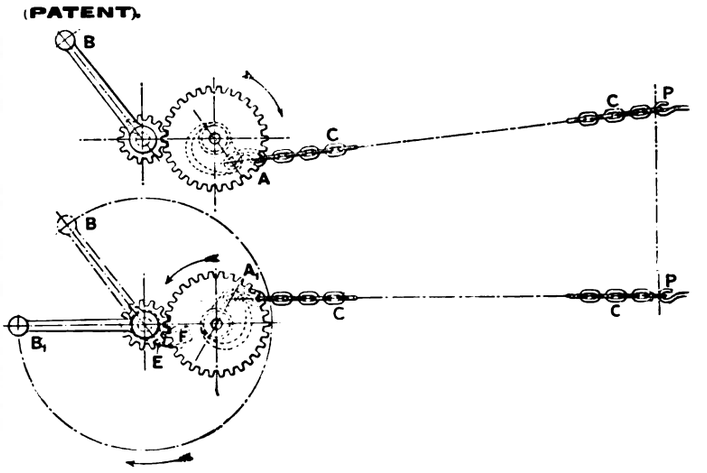
(PATENT).



THE "PEACOCK" IMPROVED BRAKE, WITH C.I. PEDESTAL.

Unless prevented, the spiral drum of any geared hand brake will overrun when the brakes are released.

In Fig. 1, P represents the end of the draw rod when the brakes are completely "off." It is obvious that the drum, by reason of its momentum (produced by the jerk of the release springs and the weight of the chain CC) will unwind in the direction of the arrow until brought to rest by the chain at A.



In Fig. 2, the drum has been brought back to A_1 by the movement of the handle from B to B_1, but the draw rod P has not yet moved. Consequently the whole of this movement of more than **three-quarters of a revolution** of the handle is **lost motion.**

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WALTHAMSTOW.—The Council have adopted a recommendation by the Tramways Committee for the issue of return tickets at reduced fares in order to meet motor omnibus competition. Councillor Lyne unsuccessfully moved the deletion of the proposal, contending that nowhere had the policy of cutting fares been successful. It had always resulted in the competing parties running at a loss, and then coming to terms. The tramway undertaking was not in a position to face loss of that kind. Councillor Bishop, chairman of the committee, said the recommendation was based on a policy every authority around London was adopting.

WEST BROMWICH.—Owing to the development of the Old Church and Churchfield districts—the area to which any town planning scheme that may be brought forward will apply—the Corporation are promoting a bill seeking powers to provide and work a trolley vehicle system at an estimated cost of £20,000, and motor omnibuses at an estimated cost of £8,000. It is also proposed to provide tramways from the centre of the borough to Greets Green.

YARMOUTH.—The working of tramways next summer will be considerably improved by the carrying out of a scheme for doubling the track at the Market Place, Theatre Plane, and Regent Road, at a cost of £8,750.

YORK.—An electric clock operated from the generating station at Foss Islands having been found to be satisfactory in its working in the Nessgate shelter, and much appreciated by the public, the Tramways Committee propose to fix a similar clock at each terminus.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given below in italics.**

APPLICATIONS.

Applications for Letters Patent have been filed:

2,109 Brake apparatus—Austin Motor Company, Limited, and H. Austin.
2,112 Compound rail construction—E. Rhodes.
2,164 Life-guards for motor vehicles—G. L. Cumberland.
2,223 Passengers' brake application and alarm apparatus for railway vehicles—A. Spencer.
2,249 Facing point guard and indication bars on railways—L. W. Williams.
2,360 Life-guards for motor vehicles—G. Daws and M. Parker.
2,413 Lubricating apparatus—Daimler-Motoren Ges.
2,418 Electric controllers — British Thomson-Houston Company, Limited (*General Electric Company*).
2,466 Tramway rails—H. Grudgington and H. T. Wakelam.
2,499 Life-saving appliances for electrically and mechanically-operated vehicles—C. R. Heiser.
2,522 Tramcars—R. Heaton.
2,542 Life-guard for motor vehicles—W. S. Vale.
2,566 Rail device which will prevent the rails from spreading—L. Tritico.
2,804 Trucks for self-propelled vehicles—British Thomson-Houston Company, Limited (*General Electric Company*).
2,811 Apparatus for sanding railway aud tramway rails—H. L. Lambert.
2,812 Tri-section tramway rail—F. J. Burnett.
2,823 Automatic life-saver for motor omnibuses—J. H. Hudson.
2,826 Life-guard for motor omnibuses and trackless trolley cars—B. Kay.
2,835 Automatic mechanical life-guards for motor omnibuses—W. H. White.
2,886 Rail anchors—J. W. Stephenson and D. C. Stephenson.
2,905 Fenders for motor-propelled vehicles—P. C. Hawkins.
2,981 Apparatus for controlling the speed of railway trains—J. Ward, jun.
3,074 Side mud-guard for motor omnibuses—J. Taylor.
3,208 Safety rail—C. E. Dobell.
3,307 Life-saving cradles for motor omnibuses—V. E. Harris and C. H. Howe.
3,309 Insulator for supporting the current rails of electric railways and tramways—A. Watkins.
3,365 Life-saving appliances for motor vehicles—E. I. Levenson.
3,371 Trolley wheels—J. W. Anderson.
3,380 Rail joints—A. Vietor.
3,384 Suspending and springing the seating bodies and wheels of motor cars, trams, trains, etc.—J. Holt.
3,392 Mechanically operated brakes—W. G. Bryan and P. B. Sheather.
3,396 Brake gear—C. P. Smith.
3,426 Clutch coupling or brake—H. J. Thomson and Thomas Transmission, Limited.
3,497 Rail joints—W. H. Moore.
3,565 Electric motor control systems—British Thomson-Houston Company (*General Electric Company*).
3,567 Lubrication of the wheels and axles of railway and tramway vehicles—J. Abbott.
3,593 Apparatus for the automatic control of railway trains—R. S. Baxter.
3,598 Life-guards for road motor vehicles—S. Hudson.
3,684 Motor control systems—British Thomson-Houston Company (*General Electric Company*).
3,685 Electric motor control systems—British Thomson-Houston Company (*General Electric Company*).
3,719 Electrically-propelled vehicle or locomotive trolleys—W. Duff.
3,725 Guard to be fixed to the front of a motor 'bus, tramcar, etc.—S. W. C. Coen.
3,750 Life-saving appliances for use on railway or road vehicles—F. S. Turner and C. White.
3,781 Life-saver for motor omnibuses—H. G. Barrington.
3,857 Trolleys for electric traction systems—E. M. Munro and R.E.T. Construction Company, Limited.
3,877 Construction of car bodies—D. K. Causton.
3,924 Route indicator for motor omnibuses—S. Wartski.
3,936 Sanding apparatus for railway and tramway vehicles—Compagnia Italiana Westinghouse dei Freni.
4,005 Trains for self-laying rail tracks—E. Perrot.
4,039 Motor life-guard—G. Fisher.
4,047 Boltless rail joints—J. D. Young.
4,093 Electric motor-controlling devices—British Thomson-Houston Company, Limited, and H. E. Britton.
4,128 Safety-guard for motor cars, omnibuses, etc.—M. Morris.
4,158 Sanding devices—S. P. Christie.
4,168 Guards for motor-driven vehicles—T. H. B. Gayner.
4,185 Means of propulsion or traction—J. F. Harper and A. Hutchison.
4,190 Automatic signal system for railways—S. C. Perry.
4,255 Guards for motor vehicles—W. Jones.
4,291 Wheels for motor omnibuses for prevention of side slips and skidding—W. E. Cocks.
4,293 Compressed air locomotives—Rudolph Akt.-Ges. fur Maschinen und Bergbau.
4,345 Insulated rail joint for track circuit railway signalling—R. C. S. Woods.
4,398 Protective devices for electric distribution systems—British Thomson-Houston Company, Limited (*General Electric Company*).

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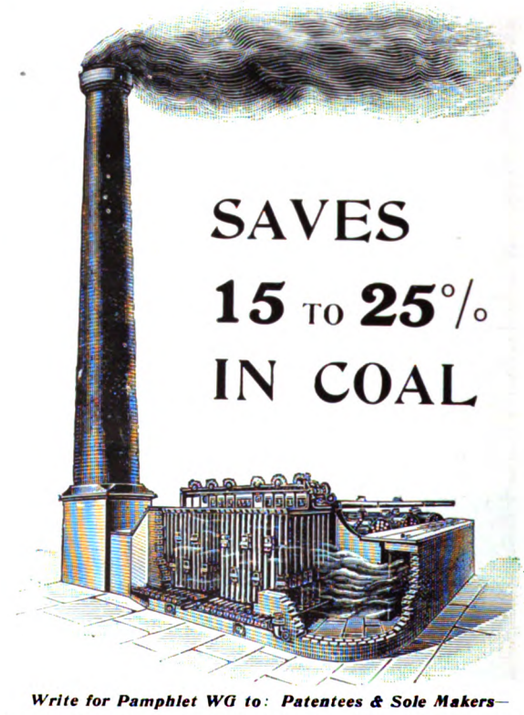

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4,406 Electric train lighting—G. W. Macartney.
4,482 Trucks or undercarriage structure for railway and tramway vehicles—M. E. Curwen (*J. G. Brill Company*).
4,523 Life-guard for motor and railway vehicles—R. A. Garnell.

SPECIFICATIONS PUBLISHED.

1912.

316 Devices for enabling the junction points of tramways to be readily moved—Stansfield.
5,352 Automatic block system for preventing collision between trains—Icard.
7,683 Destination indicators for railway trains—Scamell.
7,704 Electric controllers—British Thomson-Houston Company and Hastings.
11,871 Regulation of electric installations—Earl.
15,930 Overhead contact conductors of electric railways—Bergmann Elek.-Werke Akt.-Ges.
19,890 Electric locomotives—Maschinenfabrik Oerlikon
25,775 Connectors for electric conductors—British Thomson-Houston Company (*General Electric Company*).
819 Electric storage batteries—Niblett.
1,251 Railway and road passenger vehicles—Huppert and Paul.
2,343 Electric welding—British Thomson-Houston Company (*Allgemeine Elektricitäts-Ges.*).
5,559 Electric block-signalling systems—Siemens Brothers and Company (*Siemens and Halske Akt.-Ges.*).
7,390 Brake blocks for railway vehicles—Watson and Watson.
9,949 Tramway point-operating devices—McDaniels.
15,766 Side clamps for railway check or guard rails—Rigby.
21,143 Rail joints—Hammock.
1,252 Railway and road passenger vehicles—Huppert and Paul.
1,852 Electric tablet systems for working single lines of railway—Blackall and Jacobs.
2,011 Life-guards for tramcars—Philipson, Philipson, and Philipson.
2,144 Method of laying and anchoring tramway rails—Dawson and Foster.
10,042 Locomotives—Dawson and Lucas.
11,322 Steam sanding arrangements of locomotives—Metcalfe, Metcalfe, and Metcalfe.
17,941 Means for securing railway rails to sleepers—Patterson.
18,483 Combined railway rail chairs and sleepers—Prosser.
22,222 Rail joints—Ezard.
24,693 Rail chairs—Meuser.
3,478 Railway and road passenger vehicles—Huppert, Paul, and Tanner.
21,768 Single-track railways—Zsinko.

For **Electric Tramway Directories,** *vide* pages xxv. to xxxiv. in this issue.

TRAFFIC RETURNS.

TRAMWAYS AND OMNIBUSES.	1912. WEEKS ENDING. Feb. 2.	Feb. 9.	Feb. 16.	Feb. 23.	1913. WEEKS ENDING. Feb. 1.	Feb. 8.	Feb. 15.	Feb. 22.	AGGREGATE. Wks.	1913.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1.270	1,264	1.341	1.330	1.334	1.425	1.379	1.339	38	57,886	+ 1.170
Ayr Corporation	176	176	186	186	188	201	197	182	40	12.909	+ 383
Bath Electric	619	582	655	704	669	680	716	640	8	5.605	+ 299
Birmingham Corporation	9.015	9.158	10.665	9.578	11,495	11,455	11.347	11.164	47	512,874	+138.906
Blackburn Corporation	923	874	989	964	1.066	1.064	1,247	1.057	48½	56,052	+ 2.070
Blackpool and Fleetwood	271	245	244	271	275	278	275	282	8	2.010	+ 6
Blackpool Corporation	522	318	366	368	440	649	468	446	47	68,262	+ 6.516
Bolton Corporation	2.110	2.268	2.354	2.450	2.402	2,503	2.538	2.434	47	121,295	+ 1.788
Bournemouth Corporation	1.265	1.472	1.453	1.498	1.476	1.573	1.489	1,461	47½	86,883	+ 2.794
Bradford Corporation	4.763	4.736	5.268	5.095	5.166	5,338	4,979	5,572	47	260.055	+ 3.679
Brighton Corporation	647	759	771	774	761	771	754	688	47	47.264	− 916
Bristol	5.558	5.645	6.113	6.145	6.684	6.944	6.808	6.176	8	50.139	+ 4.090
British Elec. Trac. Co's. Undertakings											
Airdrie	249	261	257	278	291	288	293	291	8	2.235	+ 293
Barnsley	173	181	201	198	202	216	220	206	8	1.513	+ 151
Barrow	294	304	308	318	347	338	327	320	8	2,416	+ 188
Birmingham and Mid. Joint Com.:											
Birmingham and Midland	837	840	930	922	961	975	991	932	8	7,077	+ 637
Dudley-Stourbridge	699	706	784	818	824	859	831	827	8	6,081	+ 649
South Staffordshire	810	783	929	901	962	1,006	1,025	937	8	7,319	+ 1,069
Wolverhampton District	414	432	457	479	495	509	506	474	8	3,603	+ 385
Devonport	439	453	490	485	504	532	505	428	8	3,807	+ 228
Gateshead	983	955	1,015	1,019	1,061	1,101	1,083	1,054	8	7,850	+ 477
Gravesend and Northfleet	183	182	206	199	208	211	206	198	8	1,535	+ 93
Greenock-Port Glasgow	651	676	688	747	750	706	750	714	8	5,320	+ 357
Jarrow	111	108	120	116	126	126	131	126	8	902	+ 71
Kidderminster	88	80	94	102	97	91	92	89	8	668	+ 11
Merthyr	180	186	200	194	218	210	217	186	8	1,509	+ 101
Metropolitan Electric	7,657	7,575	8,242	8,480	8,424	8,196	8,428	8,034	8	62,011	+ 2.048
Middleton	251	244	282	290	290	292	285	292	8	2,134	+ 174
Oldham-Ashton	518	500	551	556	571	584	585	566	8	4,185	+ 243
Peterborough	106	112	120	119	118	118	117	117	8	875	+ 39
Potteries	1,882	1,878	2,027	2,039	2,122	2,124	2,055	1,967	8	15,227	+ 969
Rothesay	38	38	40	52	41	42	41	53	8	383	+ 48
Sheerness	42	39	42	48	46	50	43	46	8	347	+ 27
South Metropolitan	612	624	695	712	700	695	720	652	8	5,260	+ 254
Southport	206	204	221	226	228	236	245	240	8	1,766	+ 195
Swansea	1,051	1,149	1,075	1,079	1,145	1,229	1,082	1,047	8	8,432	+ 396
Taunton	35	37	39	42	43	45	40	38	8	323	+ 29
Tynemouth	122	120	133	141	151	172	174	156	8	1,166	+ 218
Weston-super-Mare	23	24	30	24	26	24	21	19	8	190	− 1
Worcester	200	215	241	241	236	246	238	216	8	1,799	+ 80
Wrexham and District	97	80	92	95	106	105	114	107	8	777	+ 115
Yorks. (Woollen) District	956	937	1,027	1,061	1,096	1,096	1,037	1,060	8	8,258	+ 853

(*Continued on page 202.*)

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TRAFFIC RETURNS—*continued.*

TRAMWAYS AND OMNIBUSES.	1912. WEEKS ENDING. Feb. 2.	Feb. 9.	Feb. 16.	Feb. 23.	1913. WEEKS ENDING. Feb. 1.	Feb. 8.	Feb. 15.	Feb. 22.	AGGREGATE. Wks.	1913.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Burnley Corporation	1.192	1.294	1.306	1.287	1.517	1.528	1.552	1.527	47	71.544	+ 6.473
Burton-on-Trent Corporation	234	258	267	261	264	265	249	244	47	12.815	− 446
Bury Corporation	999	1.117	1.136	1.207	1.183	1.248	1.205	1.193	47	59.951	+ 746
Cardiff Corporation	2.057	2.210	2.252	2.320	2.437	2.473	2.360	2.249	47	115.578	+ 607
Chatham and District	687	667	778	774	791	821	829	734	7	5.984	+ 268
Chesterfield Corporation	208	208	212	217	236	237	239	229	47	10.759	+ 94
Colne and Trawden	178	201	213	225	229	233	224	230	8	1.792	+ 157
Cork Electric	379	388	420	433	434	428	449	392	7	3.146	− 69
Croydon Corporation	1.390	1.397	1.579	1.621	1.464	1.445	1.429	1.349	47	82.371	− 1.183
Darlington Corporation	197	209	212	216	218	237	218	212	47	10.637	+ 239
Derby Corporation	794	817	899	885	851	903	862	828	47	41.843	− 1.033
Dover Corporation	164	184	188	194	196	195	188	177	47	11.254	− 544
Dublin and Lucan	110	93	106	96	127	108	106	108	8	828	+ 19
Dublin United	4.884	4.885	5.263	5.066	5.460	5.504	5.454	5.065	8	40.610	+ 1.793
Dundee City	1.041	1.100	1.110	1.115	1.133	1.195	1.190	1.147	40	48.784	+ 1.701
East Ham Corporation	987	1.045	1.101	1.124	1.108	1.111	1.053	1.064	47	51.125	− 478
Exeter Corporation	236	245	270	280	280	276	267	241	47	15.142	− 697
Glasgow Corporation	16.623	17.050	17.751	18.103	18.660	19.183	19.322	19.211	38	724.334	+ 6.389
Glossop (Urban Elec. Supply Co.)	101	112	115	116	125	124	121	113	8	962	+ 54
Halifax Corporation	1.632	1.458	1.627	1.772	1.811	1.787	1.892	1.810	46	93.450	+ 2.721
Hastings and District	615	604	724	685	665	675	730	636	8	5.778	+ 143
Huddersfield Corporation	1.649	1.777	1.813	1.844	2.028	1.982	1.932	1.947	49	94.664	+ 3.645
Hull Corporation	2.848	2.922	2.927	3.049	3.108	3.034	3.018	2.956	47	141.159	+ 2.249
Ilford U.D. Council	441	458	479	484	412	414	404	396	47	22.053	− 2.939
Ilkeston Corporation	112	122	127	124	114	114	114	111	48	5.423	− 857
Ipswich Corporation	307	320	355	355	379	354	350	330	47	20.533	+ 84
Isle of Thanet	223	243	274	287	264	283	272	256	21	6.467	− 5
Kilmarnock Corporation	134	142	142	153	152	157	150	153	40	6.615	− 80
Lanarkshire	1.274	1.289	1.421	1.438	1.486	1.423	1.586	1.508	7	11.515	+ 591
Lancashire United	1.191	1.104	1.232	1.241	1.361	1.323	1.337	1.300	7	9.443	+ 702
Leeds City	6.808	7.053	7.227	7.435	7.641	7.785	7.321	7.566	47	365.999	+ 13.827
Leicester Corporation	2.303	2.467	2.557	2.652	2.653	2.735	2.561	2.533	8	19.994	+ 1.124
Leith Corporation	554	555	582	580	629	635	629	614	40½	27.256	+ 1.078
Liverpool Corporation	10.771	11.064	11.371	11.378	11.861	12.172	11.762	11.576	7½	91.488	+ 5.184
Llandudno and Colwyn Bay	123	115	126	138	147	142	162	144	12	1.770	+ 151
London County Council	40.693	39.034	42.411	42.597	40.432	40.917	40.737	39.235	47	1.949.698	− 90.692
London General Omnibus	34.727	35.419	39.599	39.536	51.974	55.526	51.455	51.002	8	428.691	+ 128.509
London United	4.763	4.981	5.492	5.414	5.173	5.299	5.112	5.009	8	42.571	+ 238
Lowestoft Corporation	122	148	133	133	142	137	133	131	20	3.426	− 4
Maidstone Corporation	134	125	146	147	157	157	161	146	47	8.899	+ 433
Manchester Corporation	14.557	15.127	15.535	16.334	16.695	16.388	16.016	16.470	47	789.923	+ 31.664
Nelson Corporation	132	157	153	180	201	174	170	204	47½	9.240	+ 721
Newcastle-on-Tyne Corporation	3.904	4.055	4.207	4.132	4.507	4.696	4.578	4.398	47	210.312	+ 8.049
Newport (Mon.) Corporation	591	640	656	679	706	748	680	680	47	33.545	+ 342
New St. Helens and District	581	581	651	652	676	704	695	652	34	25.101	+ 721
Northampton Corporation	440	469	484	497	512	530	525	462	47	25.273	+ 210
Nottingham Corporation	2.847	2.843	3.015	3.018	3.196	3.157	3.053	2.976	47	148.689	+ 2.647
Oldham Corporation	1.598	1.757	1.850	2.000	2.034	2.019	1.991	2.063	48	98.401	+ 6.438
Portsmouth Corporation	1.477	1.542	1.693	1.634	1.706	1.795	1.704	1.503	47	98.159	− 3.953
Preston Corporation	627	627	686	713	805	785	781	745	47	38.835	+ 2.221
Provincial	1.348	1.381	1.436	1.467	1.554	1.584	1.528	1.459	21	33.530	+ 1.733
Reading Corporation	549	577	628	567	584	640	610	551	46½	30.159	− 96
Rochdale Corporation	1.102	1.230	1.265	1.354	1.438	1.423	1.384	1.430	47	71.718	+ 6.244
Rotherham Corporation	657	631	668	682	860	899	883	859	46½	37.291	+ 5.162
Salford Corporation	4.130	4.513	4.569	4.669	4.773	4.889	4.660	4.743	47	234.819	+ 5.687
Sheffield Corporation	6.131	6.399	6.441	6.600	6.957	7.519	7.081	6.895	47½	327.630	+ 17.428
Southampton Corporation	1.045	1.009	1.100	1.100	1.157	1.150	1.144	1.036	46	57.580	+ 107
Southend-on-Sea Corporation	420	385	462	484	539	538	572	516	47	35.799	+ 4.265
South Shields Corporation	531	538	573	556	617	623	617	591	47	30.037	+ 876
Sunderland Corporation	1.067	1.226	1.117	1.258	1.251	1.371	1.232	1.236	47	61.626	− 429
Swindon Corporation	138	140	149	149	149	147	156	134	47	7.274	− 285
Tyneside Tramways and Tramroads	403	379	419	422	437	454	480	478	8	3.121	+ 66
Wallasey Corporation	892	906	940	949	982	999	984	945	47	51.582	+ 53
Walsall Corporation	503	551	574	577	599	619	573	570	8	4.482	+ 195
Walthamstow U.D. Council	572	582	650	657	632	652	610	620	47	33.522	− 1.109
Warrington Corporation	395	389	406	404	439	450	446	435	47	20.376	+ 1.388
West Ham Corporation	2.457	2.373	2.607	2.596	2.645	2.577	2.499	2.460	46½	122.764	− 3.813
Wigan Corporation	1.233	1.177	1.269	1.278	1.404	1.394	1.381	1.312	46½	63.102	+ 2.861
Wolverhampton Corporation	882	940	956	952	1.014	1.008	941	931	48	48.964	+ 2.088
Yorkshire (West Riding)	1.281	1.164	1.268	1.267	1.283	1.595	1.266	1.285	8	10.457	+ 699
FOREIGN TRAMWAYS.											
Anglo-Argentine	50.744	51.540	51.758	47.909	53.204	54.907	55.252	55.202	8	437.735	+ 35.310
Auckland	...	...	...	...	...	...	...	...	—	—	—
Bombay	3.133	...	...	...	3.060	...	...	...	5	13.551	+ 192
Brazilian Street (month) Mlrs.	45.209	...	...	...	47.268	...	...	...	26	265.122	− 179
Brazilian Traction	...	...	...	...	85.417	94.955	88.326	88.867	8	698.224	—
Brisbane (month)	17.034	...	...	...	24.810	...	...	...	4	24.810	+ 7.776
British Columbia (month) $	517.247	...	...	...	584.032	...	...	...	30	4.020.498	+ 701.857
Buenos Aires Port and City (month)	7.071	...	...	...	6.428	...	...	...	4	6.428	− 643
Buenos Ayres Lacroze (month)	42.376	...	...	...	44.703	...	...	...	30	308.829	+ 35.109
Calcutta Rs.	59.340	60.278	60.240	58.554	61.392	63.690	60.302	62.254	8	5.21.784	+ 1.807
Cape Town (month)	12.805	...	...	...	13.895	...	...	...	4	13.895	+ 1.090
Carthagena and Herrerias (month)	1.532	...	...	...	3.324	...	...	...	4	3.324	+ 1.792
East India (month)	1.874	...	...	...	1.850	...	...	...	26	11.380	+ 2.185
Kalgoorlie (month)	2.884	..	...	...	2.734	...	...	...	4	2.734	− 150
La Plata (month)	4.610	...	...	...	5.574	...	...	...	4	5.574	+ 964
Lima (month)	32.434	...	...	...	34.200	...	...	...	4	34.200	+ 1.766
Madras Rs.	24.128	(2 weeks)	23.239	(2 weeks)	26.530	(2 weeks)	25.388	(2 weeks)	6½	78.508	+ 7.595
Melbourne (month)	64.000	...	...	...	67.000	...	...	...	4	67.000	+ 3.000
Mexico (month) $	542.779	...	...	...	561.635	...	...	...	4	561.635	+ 18.856
Montevideo (month)	35.051	...	...	...	38.061	...	...	...	13	102.167	+ 11.355
Para $	3.825	4.089	4.312	4.018	4.122	4.469	4.266	4.229	12	49.190	+ 3.116
Perth (W.A.)	2.088	1.879	1.870	1.905	2.211	2.168	2.164	2.094	8	16.247	+ 1.736
Port Elizabeth (month)	4.026	...	...	...	4.498	...	...	...	4	4.498	+ 472
Shanghai $	17.234	18.897	18.131	20.355	19.000	22.800	20.000	19.400	7	138.400	+ 9.714
Singapore $	9.327	10.014	11.225	11.660	9.598	13.468	12.082	12.360	8	91.030	+ 8.464
Toronto (month) $	656.110	...	...	...	776.928	...	...	...	4	776.928	+ 120.818
Winnipeg (month) $	319.433	...	...	...	351.497	...	...	...	4	351.497	+ 32.064
ELECTRIC RAILWAYS.											
Central London	5.126	5.066	5.012	5.002	5.673	5.206	5.500	5.495	8	44.261	+ 3.360
City and South London	3.450	3.464	3.328	3.333	3.066	2.917	3.108	3.082	8	24.664	− 2.707
Great Northern and City	1.759	1.751	1.731	1.727	1.580	1.539	1.570	1.552	8	12.490	− 1.501
Liverpool Overhead	1.480	1.462	1.481	1.497	1.544	1.594	1.525	1.550	8	12.757	+ 868
London Electric	14.845	14.805	14.845	14.850	15.050	14.255	14.725	14.580	8	118.800	− 1.245
Mersey	2.208	2.143	2.178	2.143	2.310	2.263	2.287	2.257	8	18.126	+ 1.001
Metropolitan	16.624	16.244	16.521	16.546	16.726	16.275	16.332	16.145	8	132.886	− 1.500
Metropolitan District	12.573	12.664	12.738	12.911	13.317	13.035	13.208	13.073	8	106.229	+ 4.348

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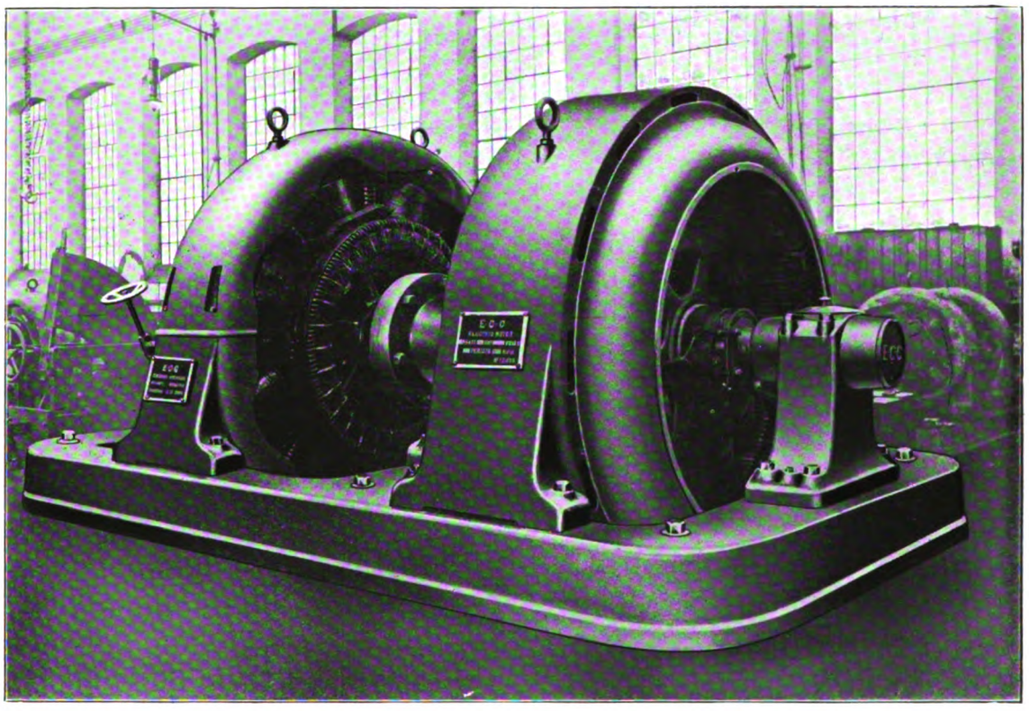

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TOWER WAGONS,
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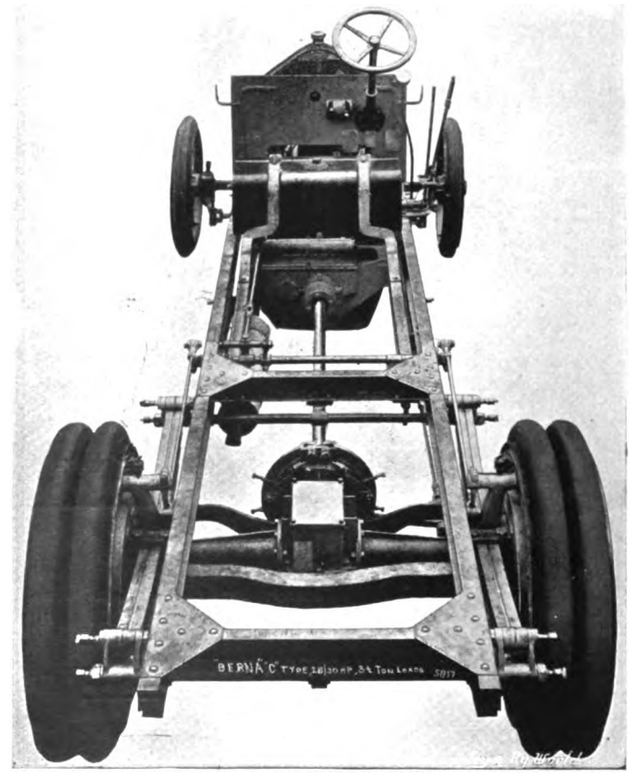

Berna 3½-Ton Chassis. Rear View Showing Differential and General Arrangement.

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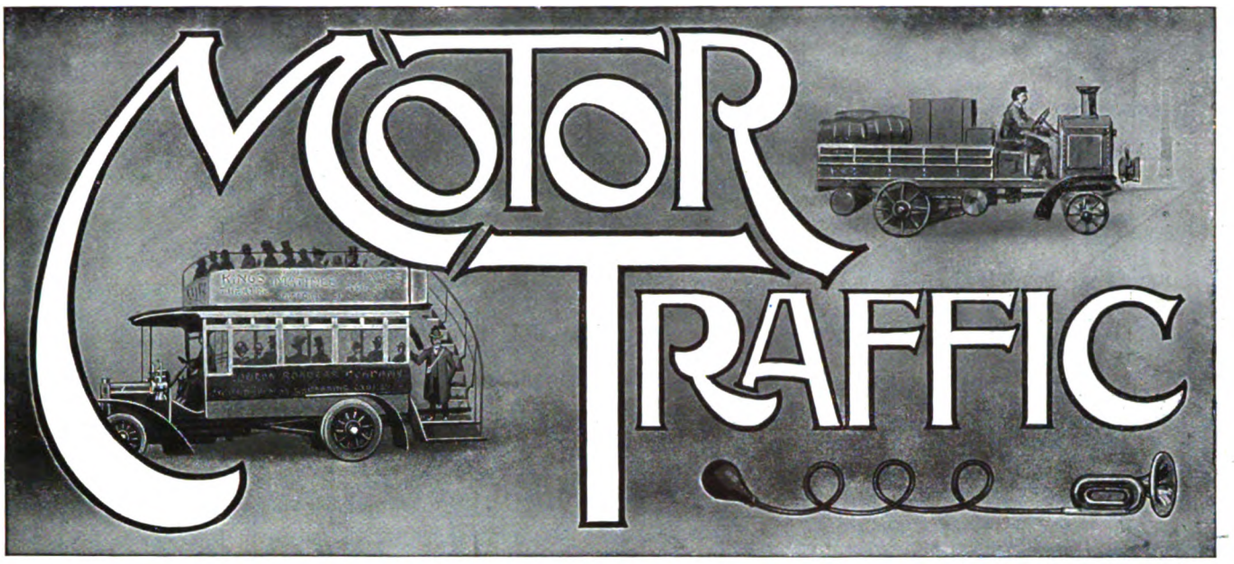

The persistent manner in which the manufacturers of industrial motor vehicles have demonstrated the capabilities of mechanical traction is meeting with its reward, judging by the success of the recent exhibition at the City Hall, Manchester. For the first time during the series of motor shows which have been held in the North of England, the industrial vehicle has had a show to itself, as the pleasure car section was separately catered for at Rusholme, on the outskirts of Manchester. The result of the separation of the two interests was the absence of the crowding so noticeable on previous occasions, and purchasers were therefore able to examine the exhibits in a manner hitherto impossible. That this has led to satisfactory business for the majority of the exhibitors, is a matter of common knowledge, and the organisers are to be congratulated for their foresight. In view of the fact that Manchester is the centre of a large district where heavy road haulage is the common practice, it was to be expected that special attention would be given to the requirements of the locality, and that a special feature would be made of vehicles capable of taking loads of four tons and upward. This anticipation was fully met, for not less than 18 of the machines staged were of this class. The popularity of the chars-a-banc is becoming more pronounced each year, and evidence that the manufacturers are alive to the possibilities in this direction was to be seen in the staging of as many as ten of these vehicles. The tendency on the part of the travelling public to demand increased comforts, is also being catered for, so that in many instances the design and upholstery of these conveyances would compare favourably with an expensive private touring car. All this is in the right direction, and we feel confident that with a better knowledge of the great advantages to be derived from motor vehicle services, both for the transport of goods and passengers, the large carrying companies as well as municipal authorities will become liberal supporters of the motor industry.

Perhaps there has never been a more typical illustration of the confusion which arises from our piecemeal and hasty system of legislation than is afforded by the institution of the Development Commission and their junior partners, the Road Board, nearly three years ago. The new bodies were an offshoot of a Parliamentary grant and the Budget tax of 3d. per gallon to private owners and 1½d. to medical men and public passenger vehicle owners. The work which the Road Board were to accomplish was to be the solatium for the increased cost of spirit. To expect politicians in this country to regard the experiences of the Development Commissioners and the Road Board as a warning against embodying hastily conceived legislation in the Budget is perhaps a too sanguine attitude to adopt, but after the outcry which the Road Board's work has given rise to by local authorities during the past two years it is to be hoped that the Treasury and Mr. Lloyd George will make some effort to place matters on a better footing in the Budget due to be introduced next month. This might be done temporarily at least, while at the same time a committee might be appointed to frame a report and recommendation upon which Parliament can be asked to leisurely consider proposals worthy of being brought into force for a period of years. Into those proposals the railless trolley car clauses, withdrawn from the new Light Railways Bill on account of unfavourable amendment, might be included. The time limit of five years, placed upon the operation of the funds of the Development Commissioners and the Road Board, is a satisfactory feature of the Development Act, but there are strong reasons why the road problems, which have been intensified by the imposition of the petrol duty, should not be allowed to irritate local authorities and the ratepayers against motor traffic for a further period of two years.

The demands which the authorities of London and the adjoining counties have unanimously put forward for a share of the petrol taxation to defray the cost of rendering roads fit for heavy motor vehicles and motor omnibuses, deserve a more effective answer than has been vouchsafed by Sir George Gibb and his colleagues. A sum equal to about three-fiths of the petrol tax in London for a year is now being apportioned towards the cost of wood paving, resurfacing with tar macadam, asphalt, and other bituminous binding. This allowance would scarcely be termed generous even if only the traffic of light motor vehicles had to be considered. London's claim is with regard to heavy vehicles, and, moreover, account should be taken of the past two years in which the Metropolitan and neighbouring authorities have not received a penny. Shortly after the agitation of the various Councils had reached a head the Road Board announced that they had decided to issue "loans" to them. Apparently there has been a sensible change in the announcement to grants instead of loans, for reports of local Councils who have

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MOTOR TRAFFIC.

received the Board's offers refer to what appeared to be grants in aid and not loans. To offer loans would be to add insult to injury. Moreover, the Board were never intended to be constituted for the purpose of acting as a rival to the Public Works Loan Board. Although the Road Board seems bent upon amassing a reserve of a million sterling, with the laudable intention of holding a reserve against a period of depression, so that unemployment may thereby be reduced, the function of the Board is to distribute the money paid by motor owners for a specific purpose. There need be no fear of depression limiting the amount available from the petrol tax, for this is likely to increase, even though the Chancellor of the Exchequer is expected in his forthcoming Budget to put a tax on the efforts now being made to encourage the production of benzol as a home-made fuel. If in the following year he extends his net to paraffin, Mr. Lloyd George may find that he has created stupendous difficulties to people who use the oil as an illuminant.

More than one Parliamentary Committee have given consideration to road matters and the system of Government grants made in respect to main highways, but so far the creation of the Road Board represents all that British statesmanship has been capable of towards setting up a Roads and Bridges Board such as exists in several other countries. The Secretary of the Local Government Board recently announced that the Departmental Committee on Local and Imperial Taxation are considering the question of the Road Board's Fund in relation to taxation. This is not surprising in view of the representations lately made by county and borough authorities all over the Kingdom, which were emphasised a few weeks ago by a deputation from the County Councils of Scotland, who made a point of the fact that the pleasure motor traffic is now national, and that taxation of local property to meet the cost of the roads is not an equitable arrangement. If the fear is expressed that the officialism of the Treasury may prevent effective reform, the supporters of that view count without paying regard to the influence of Sir George Gibb and his colleagues, to say nothing of Mr. Rees Jeffrey, their secretary, who from his entry into motoring organisations ten years ago, has more than any other person devoted attention to the question of reform of road maintenance and construction. As a body of practical men they must feel that farcical and contradictory aspects enter into some of the work and into that of the Development Commissioners. Two such considerations are apparent in connection with points put forward in their second annual report. So far no applications have been granted for grants for the provision of motor services. Three applications received from Ireland were refused owing to the uncertain prospects of the schemes, and in order to discourage similar ventures the Board have decided not to entertain requests for grants but to receive applications for loans on condition that a reasonable proportion of the capital is in hand, and that in the case of motor services provision is made where necessary for maintaining the roads. The Act was intended mainly for the development of agricultural districts, but a traction scheme by one authority would stand little chance of being sanctioned unless every authority affected were willing to take a share of the road maintenance. To insist upon anything more than an understanding to that effect would be to run counter to the position hitherto upheld by Parliamentary Committees, viz., that railless cars should not be compelled to specially accept liabilities for road maintenance. The Development Commissioners were also keen enough to see that traction enterprises would be encouraged if the Act permitted loans to be made to companies. Rather late in the day the Agricultural Organisation Society have now recognised the possibility of forwarding traction schemes without looking for any profit for themselves, and it is to be hoped they may find that the restrictions imposed by the Commissioners are not insurmountable. The only other effort which is being made to work the Act, and one which is the most encouraging, relates to the counties of Aberdeen, Kincardine, and Banff, where an association has been formed for the purpose of supporting light railway schemes.

OMNIBUS LIFE-GUARD TESTS.

During an interval in the proceedings of the Select Committee of the House of Commons on traffic accidents in London, on February 4, the members of the Committee assembled in Palace Yard to witness a number of experiments with various types of life-guards on some dozen motor 'buses, but it cannot be said that the results were particularly satisfactory. There were several types of guards similar to the Tidswell tramcar guard, with the exception that the swinging gate was absent. Other forms consisted of shields in the form of large mudguards fitted in advance of the front wheels, and also of the plough type of guard, fitted underneath the 'bus to prevent a person, having been passed by the front wheels, being damaged by the gear box, etc. In every case the dummies were run over, or got wedged between the ground and the guard. In no case was the dummy actually picked up. A little more successful were some experiments with guards fitted between the front and rear wheels on the sides of the 'bus, but by no stretch of the imagination can the trials be said to have approximated to anything approaching satisfaction.

CANADIAN OPENINGS FOR BRITISH MAKERS.

It is estimated that £250,000 were spent in the purchase of pleasure and commercial motor vehicles at the show recently held at Montreal. The Canadian magazine *Motoring* states that $118,000,000 have been spent on automobiles in Canada during the past decade, and that there are at the present time some 50,000 machines in use. Of these, 80 per cent. were imported from the neighbouring Republic, from Great Britain 3 per cent., France and other foreign countries 1½ per cent., leaving the balance as Canadian.

Tilling-Stevens Vehicles for Warrington.—W. A. Stevens, Limited, 26, Victoria Street, Westminster, have received an order for double-deck motor omnibuses on the Tilling-Stevens petrol-electric system for the Warrington Corporation Tramways Department.

Manchester Corporation Motor Omnibuses.—In a communication to Northenden Council the Tramways Committee of Manchester Corporation have stated that they will shortly purchase motor omnibuses of a modern type in order to improve the service of motor omnibuses now running to the town mentioned.

De Dion Bouton Omnibuses.—At the meeting of the London De Dion Company last year, the announcement was made that public passenger vehicles manufactured by the company for running in London had passed the police tests. Twenty similar omnibuses, with 20-H.P. four-cylinder engines, have been ordered for Vienna.

Lacre Motor Road Sweepers.—An 18-H.P. two-cylinder engine propels a motor road sweeping machine which the Lacre Company, of Letchworth Garden City, have supplied to the Glasgow City Council. The vehicle has solid rubber tyres, and is fitted with a detachable tank to carry water for laying the dust created by the brush when a road is very dry.

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MOTOR TRAFFIC.

COMMERCIAL MOTOR EXHIBITION AT MANCHESTER.

The Lancashire, Cheshire, and North Wales District Committee of the Society of Motor Manufacturers and Traders have every reason to be satisfied with the amount of patronage accorded to the annual exhibition of commercial vehicles held from February 14 to 22 inclusive, in the Manchester City Hall. One decided improvement was the relegation of the pleasure vehicles to a hall at Rusholme, the separation of the two classes being convenient both for exhibitors and visitors. There was again an increase in the number of firms exhibiting the commercial and industrial vehicles, as well as of makers and dealers in tyres and accessories. Now that solid rubber tyres are used for the heaviest vehicles the exhibits of tyres have become especially prominent. According to all accounts exceedingly good business was done, and it is worthy of mention that at the dinner which preceded the opening of the exhibition, the Lord Mayor of Manchester expressed his belief that in the Manchester district the commercial motor would before long take the short-distance traffic from the railways. Notices of the prominent exhibits are appended.

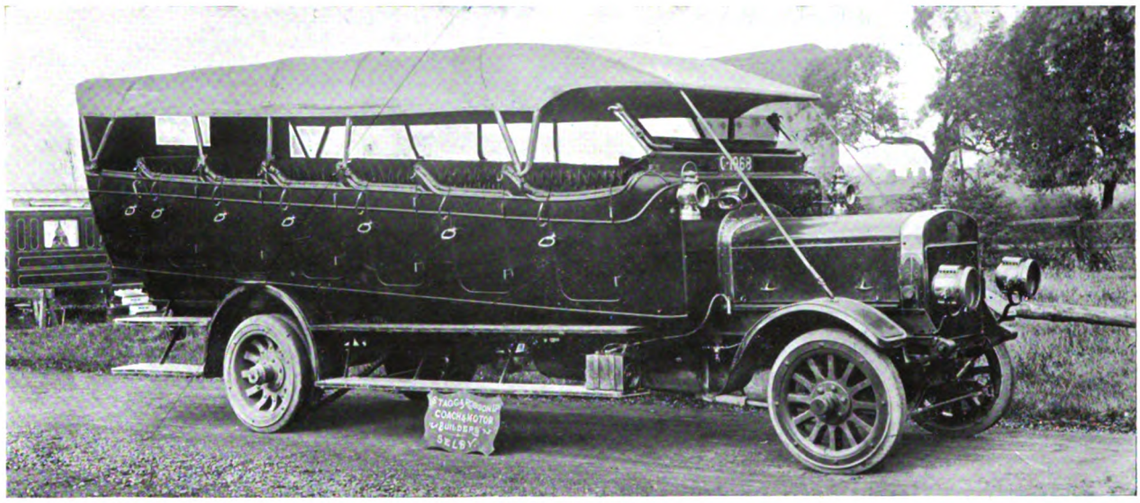
In view of the fact that the Manchester Corporation tramways department were in the market for four motor omnibuses, special attention was paid this year to the public service side of the motor industry, a large number of motor chars-a-bancs and chassis suitable for passenger-carrying vehicles being staged. Two firms—Daimler Company, Limited, and W. A. Stevens, Limited—each had a double-deck omnibus, of similar types to those in service in various parts of the country, available for demonstration purposes during the exhibition. This practice was also followed by a number of other exhibitors with various types of vehicles suitable for goods and passengers.

Stagg and Robson, Limited.—This Selby firm of body builders exhibited a chars-a-banc of excellent design and workmanship. For comfort and appearance it compared very favourably with a private touring car. The firm's standard of excellence is due to the careful study of the particular conditions under which this class of vehicle is required to run. The model shown was fitted with a 40-H.P. 4-cylinder engine, 5 in. bore by $5\frac{1}{4}$ in. stroke, Bosch dual ignition, champion patent clutch, and silent chain drive. The body was the firm's royal model high capacity touring body, specially constructed to give the maximum of comfort and suitable for long journeys. The shaped lights in storm curtains insure pleasant travelling under the worst of weather conditions.

Dennis Bros.—The exhibit of Dennis vehicles was in the hands of Staffords, Limited, the Manchester representatives, and consisted of three examples of the production of this well-known firm. The most important was a 60-H.P. Dennis-Gwynne motor fire engine constructed for Leeds, being a duplicate of one already delivered. Dennis Bros. were the pioneers in motor fire appliances, and a large number of the London and provincial fire brigades, as well as several important Colonial brigades have now been equipped by them. A chars-a-banc was one of several on order for Bourne. It was in every way a most desirable vehicle, mounted upon a standard 20-H.P. chassis with the Dennis patent worm drive, and was upholstered in a most comfortable style. The third exhibit was a 30-cwt. box van, constructed for demonstration work in the Manchester district.

Fodens, Limited.—At this stand there were two models—a 5-ton standard, with flat lorry top platform, with two loose loading flats, on steel tyres to carry and draw loads up to eight tons at five miles per hour, and a 3-ton standard model on rubber tyres, capable of dealing with loads of three tons at 12 miles per hour. The former was fitted with the Foden 35-H.P. 2-cylinder (compound) engine, and the latter with the 30-H.P. engine. The popularity of the Foden wagon, both with and without rubber tyres, has been remarkable, and speaks volumes for the excellent service they have given in all parts of the country.

Belsize Motors.—As was to be expected from a local firm of their reputation this company had a most comprehensive display of the various models for which they have created a demand Six distinct models were staged as follow: 28-H.P. 4-cylinder 3-ton chassis, worm-driven back axle; 18-H.P. 4-cylinder chassis, fitted with 19-seated chars-a-bancs body, chain driven; 14-16-H.P. 4-cylinder 15-cwt. canvas top van, worm driven; 10-12-H.P. 4-cylinder 5-cwt. van, worm driven; 14-16-H.P. 4-cylinder 4-seated taxi cab complete; and 10-12-H.P. 4-cylinder 2-seated taxi cab complete. The 3-ton chassis, which was the only bare machine, gave visitors an opportunity of satisfying themselves as to the excellent design and workmanship of the Belsize productions. The chars-a-banc is one of three models which the company have standardised, a heavier and a lighter type being also supplied. The two cabs shown are exactly similar to many running in London and the provinces.



Stagg and Robson Touring Car.

Sidney Straker and Squire, Limited.—This firm confined their exhibit to one model only, their new C.O. 3-ton chassis specially suited for motor omnibus work. The engine is a 36-H.P. 4-cylinder standard Straker and Squire, with the cylinder cast in pairs $4\frac{1}{4}$ in. by 5 in., and is provided with automatic lubrication, Bosch high-tension magneto ignition, the cooling being on thermo-syphon principle. The gear box is of the silent chain type, providing three forward speeds and reverse with gate change, the gears being in constant mesh. The worm drive on the back axle is a new feature in the Straker models. The worm is of special case-hardened steel, and the worm wheel of hard phosphor bronze. No load stresses are taken by the driving axle as the wheels rotate on the ends of the tubular casing which encloses the driving axle. Messrs. Straker and Squire have two other practically similar models, viz., C.O. 1 and C.O. 2, which the type shown represents, the difference being slight, and due to the class of work for which the particular chassis is required.

Milnes-Daimler-Mercedes, Limited.—The well-known Milnes-Daimler vehicles were in the hands of the firm's North of England representatives, Messrs. J. A. Lawton and Company. There were four models, which, as explained in a previous issue, have been redesigned in accordance with modern practice. The three chassis shown were a 6-ton, suitable for all kinds of heavy haulage; a 5-ton, specially suited for railways and carting agents; and a $2\frac{1}{2}$-ton machine of special design for service where speed and durability are required. This chassis has the new Mercedes engine, and is fitted with a bevel-geared

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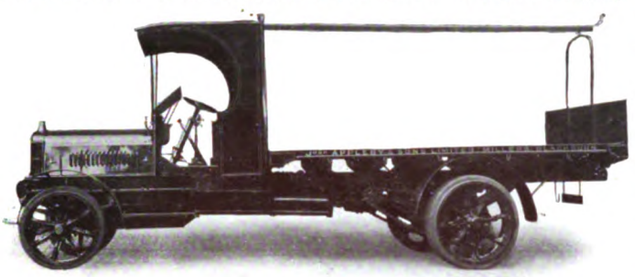
MOTOR TRAFFIC.

live axle. It should be popular for railway parcels delivery, stores vans, tower wagons, etc. The fourth exhibit was a well-designed chars-a-banc. It is only necessary to recall the excellent work done in this direction by Milnes-Daimler in the pioneer days of motor traffic to assure readers of the excellence of this model. Attention to detail,



Halley 5-Ton Lorry.

both as regards the general design of the vehicle as well as for the comfort of the passengers, was clearly demonstrated.

Halley's Industrial Motors, Limited.—The three types of vehicle made by this company were staged, viz., a 40-H.P. 4-cylinder 5-ton van

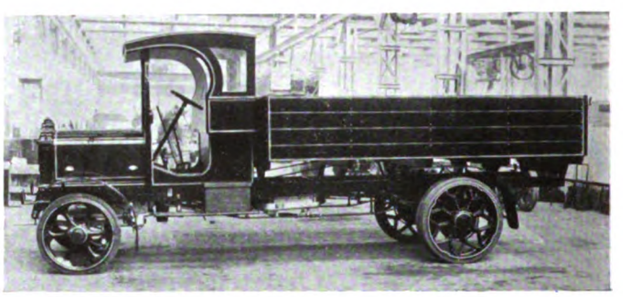
Halley 25-Cwt Delivery Van.

(being the third repeat order for Appleby and Sons, Limited, Blackburn), a 28-34-H.P. 3-ton chassis, and a 25-H.P. van. The Halley standard practice was followed, including the constant mesh type of gear box.

Daimler Company.—In view of the popularity of the Daimler silent omnibus it was to be expected that the exhibit of this standard chassis, together with that of the London General Omnibus Company B type, would attract widespread notice. This expectation was fully realised, and the well-arranged stand on which were staged three examples of the products of the Coventry works, in addition to the London General Omnibus Company chassis, received constant attention throughout the run of the exhibition. The standard 40-H.P. Daimler chassis was fitted with Continental tyres and was similar to those so successfully running in London and elsewhere, which have already been described in this journal. The standard Daimler lorry is a similar machine fitted with a frame-sided body, and constructed to take a paying load of four tons. This was loaded with paper to its full carrying capacity. The third machine was fitted with a chars-a-banc body constructed to seat 28 passengers, and sold to Mr. Kingham, New Brighton. The body, of exceptionally handsome appearance and fine finish, was built for the Daimler Company by Messrs. Stagg and Robson, of Selby.

The Wolseley Tool and Motor Car Company, Limited.—The single exhibit of this company on the stand of Max R. Lawrence, their Manchester agent, was a 16-20-H.P. chassis fitted with an ambulance body of special design. This was constructed to carry two stretchers placed one above the other, a patented arrangement ensuring the raising of the patient to a horizontal position when the ambulance is descending a hill.

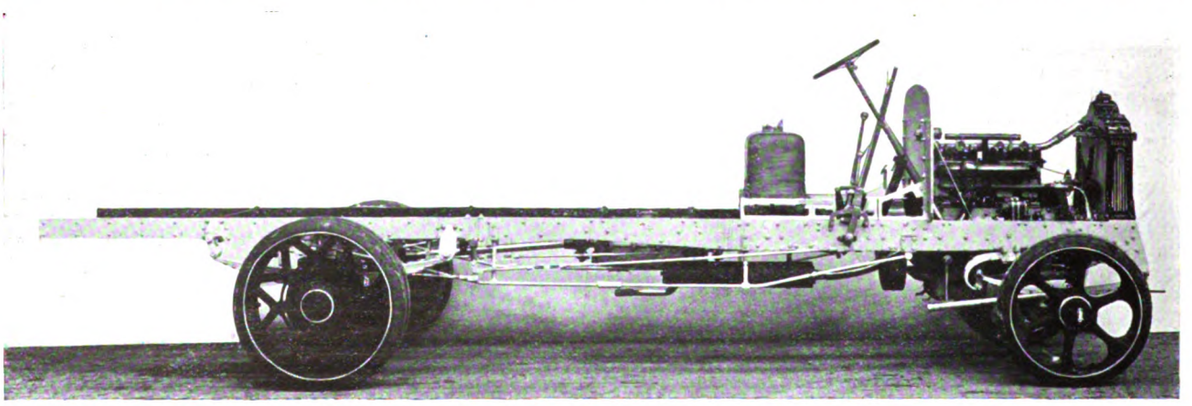
J. and E. Hall.—This company also exhibited on the stand of Max R. Lawrence, their representative in Manchester and district. The 32-H.P. 4-cylinder "Halford" 3-ton wagon shown was of the War Office subsidy type, the leading features being thermo-syphon water circulation, with an entirely enclosed engine. The gear box gives four forward speeds, the low and high gears being in relation of 5 to 1. The body fitted was the standard type adopted by the Mechanical Transport Department of the War Office.



Daimler 4-Ton Lorry.

Commercial Cars, Limited.—A flat platform lorry mounted upon the company's "Bridgewater" type of chassis was fitted with a 32-H.P. 4-cylinder engine. It is designed for a load of four tons, including body. This vehicle was built to the order of Greenhall, Whitley, and Company, brewers, Warrington, who have several similar machines at work.

Maudslay Motor Company.—The company were represented by Messrs. Leach and Seed, their sole agents for Manchester and district, who staged two excellent examples of the output of this old-established firm, and in addition displayed the special form of back axle, a distinctive feature of the Maudslay design. Maudslay industrial vehicles have for years been deservedly popular for passenger carrying purposes, and six of the company's double-deck omnibuses are still in service, having done over 200,000 miles each up to December 31, 1912. Lever Brothers, Port Sunlight, have placed an order for 12 Maudslay 4-ton vans. The two vehicles shown were a 5-ton 40-H.P. chassis, and a 3-ton 32-H.P. chassis fitted with a chars-a-banc body constructed to seat 30 passengers.



Daimler 4-Ton Chassis.

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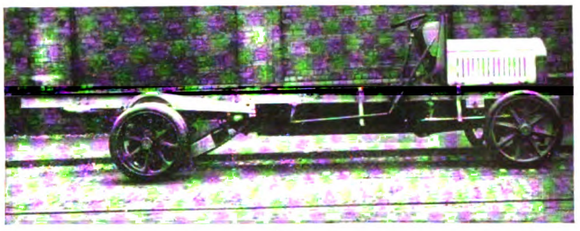
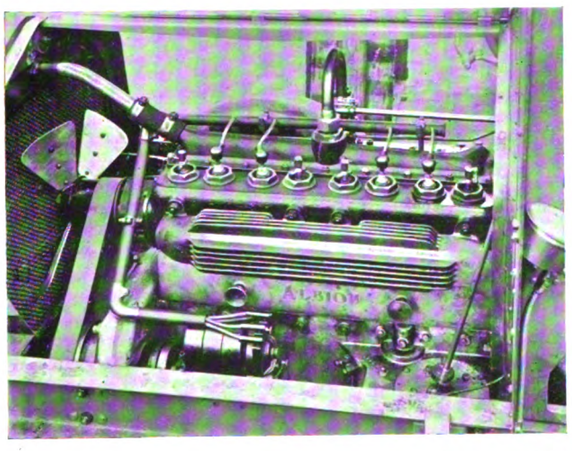
MOTOR TRAFFIC.

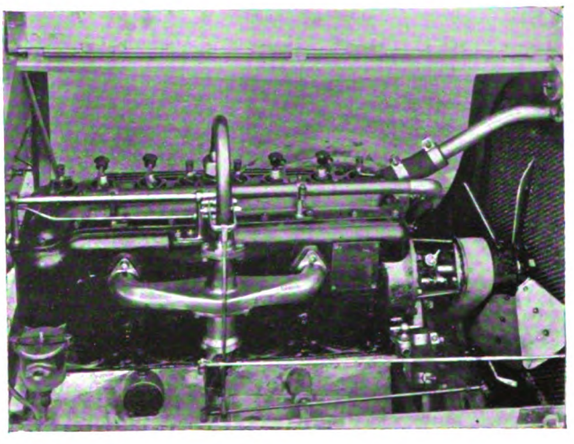
Albion Motor Car Company, Limited.—Here the chief exhibit was the new 32-H.P. 4-ton Albion chassis. The latest production of the Scotstoun firm is designed to carry net loads of four tons, or gross loads including body up to five tons. The new model is evolved from the well-proved and standardised 3-ton type. The engines and gear boxes in the two are identical, as also are the front axles—most valuable features for those users running large fleets of vehicles of various capacities. Such parts as the frame, rear axle, and springs have had to be redesigned to take the heavier loads. We reproduce several photographs of the new vehicle and its power and transmission units. The channel frames are 6 in. by 2½ in., and have stiff tubular members between the frames at frequent intervals. The standard wheels are suitable for 860 by 140 mm. band tyres, single on front



Albion 4-Ton Chassis.

and twin rear. The actual chassis photographed, however, was fitted with its own wheels, Polack tyres, on the rear only. The front wheels were shop service wheels. It will be noticed that the tyres are of very ample section, a feature worth paying for. The engine, of which two views are shown, is of the 32-H.P. Albion 4-cylinder type. The diameter of the cylinders is 4½ in. and the stroke 5 in. The Albion patent mechanical lubricator provides a measured supply of oil to each main bearing, each crank pin bearing, and each cylinder, and is responsible for the smokeless exhaust of these vehicles. Ignition is performed by a Bosch magneto having variable firing point regulated by a hand advance lever. The clever arrangement of fan and water circulation pump is used, and combined with radiator of good capacity, the system ensures efficient cooling under the most severe conditions. On the latest type of carburettor great thought and care have been expended in order to produce a carburettor of maximum efficiency requiring the minimum of attention. In one of the views of the engine, the positions of the float chamber and carburettor are plainly seen. In the other photograph, the magneto and the patent





Engine of Albion 4-Ton Chassis.

combined fan and pump are shown. Care has been taken to dispose of the leads from the magneto to the sparking plugs in a neat manner. The clutch is of the Albion patent single-disc type, the driving members of which are faced with ferodo lining. The driving connection between the clutch and the gear box is made by a tubular propeller shaft which is universally jointed, the front joint being contained in the clutch. The speed change gears and differential are contained in a single double compartment casing, of cast aluminium. All the gear shaft bearings are of special bronze, and the various end pressures are taken by ball thrust washers of ample capacity. The differential casing is carried on ball journal bearings, and the outer ends of the cross shaft are also so borne, the chain sprockets running on the ball bearings. The speeds are controlled by a single lever on the gate system. With the standard gearing and wheel diameter, a road speed of 12 m.p.h. is provided, but for specially severe conditions road speeds down to about 9½ m.p.h. can be obtained. The company pin their faith to chain drive for heavy vehicles, and the demands for chain-driven Albion vehicles of all capacities is testimony to the efficiency of the chain drive. Speed reductions are obtained by fitting chain pinions with fewer teeth and when this is done the hill climbing ability of the vehicle is proportionately increased. The central portion of the rear axle is of I section with large bearing surface. Plain bushes are used for the rear wheels. The rear springs are free to carry the load only, as the braking torque and the driving thrust are taken up by the substantial combined radius and torque rods, on which provision has been made for adjusting the tension of the chains. The springs, being designed for the single duty only, enable an easy riding vehicle to be produced. The 4-ton chassis will be another link in the chain of Albion successes, which include a large range of commercial and public service vehicles.

Berna Commercial Motors, Limited.—In addition to the 3½-ton chassis (illustrated in our issue for February 6), the Berna exhibit embraced an excellent example of their 5-ton model. This is fitted with a 35-40-H.P. 4-cylinder engine, and the general impression of the large number of visitors who carefully examined the machine in detail was that the Berna Company's claim for strength, accessibility, and simplicity is well justified. The principal features of the Berna chassis are common to both types. The inlet and exhaust valves are operated by one cam shaft, the ignition is by Bosch high-tension magneto, while the Berna special automatic carburettor gives excellent results on all kinds of motor spirit. The whole gearing is encased and provided with ball bearings, automatically lubricated. Three brakes are fitted. The good work done by the Berna machines in all parts of the world has given them an enviable reputation, and at the present moment a 5-ton machine exactly similar to the one exhibited is engaged in an interesting duel with steam wagons, in order to assert its suitability for hauling heavy loads in the hilly districts of Lancashire and Yorkshire.

Shrewsbury and Challiner Tyre Company, Limited.—A comprehensive display was made of their "World" and "Giant" tyres suitable for all kinds of industrial motor vehicles. A special pattern which attracted attention was a crossed ribbed section tyre, which has been designed for fire engines, and is said to have remarkable non-skid properties.

St. Helens Cable and Rubber Company.—This firm, so well known for their manufacture of cable, have now devoted a section of factory to the production of high-class tyres, known as the "British" band tyre and the "Cairns" tyre. The latter is a sectional tyre having a number of air spaces in each section. It is claimed that this form of tyre gives greater resilience than the solid, and very little less than the pneumatic. It is guaranteed for 8,000 miles.

Wallington, Weston, and Company.—In the manufacture of the Frome tyre this firm have had 10 years' experience. A special form of tyre included in their exhibit was one having a concave profile, for which much greater resilience is claimed than with the ordinary form. They are also the manufacturers of a special section non-skid tyre for fire engines, which is understood to be giving great satisfaction.

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MOTOR TRAFFIC.

Clayton and Company.—Four models of the popular "Karrier" machines were shown. These were a 16-H.P. chassis with silent side chain transmission to back axle, a 30-H.P. lorry fitted with Karrier patent mechanical hoisting gear, a 5-ton 40-H.P. lorry, and a 40-45-H.P. chars-a-banc to seat 28 passengers. This type of chassis is specially constructed for passenger work; it is fitted with shock absorbers and roller bearings throughout. The "Harrogate" type of torpedo body, with spring cushions upholstered in leather, and supplied with wind screen and hood, certainly makes an ideal vehicle for touring.

Karrier Touring Car for Public Service.

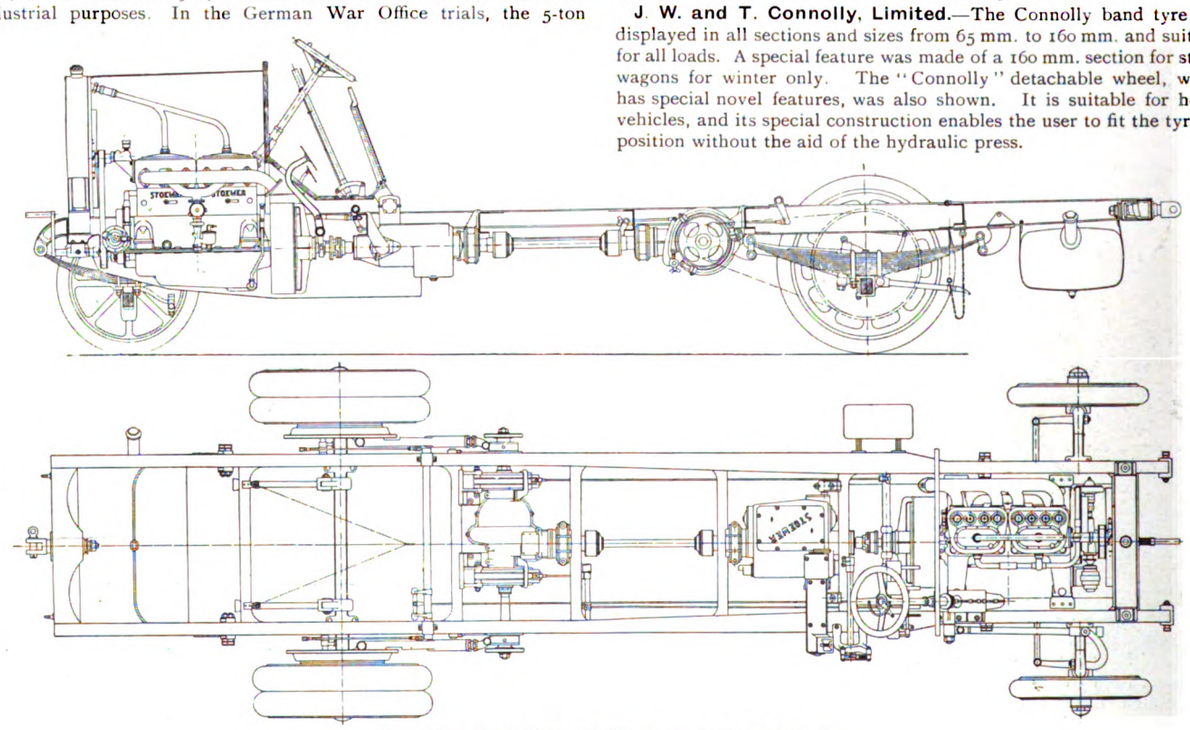
Stoewer Brothers—The 5-ton chassis shown on this stand, although new to the British market, comes with an enviable reputation for good work in Germany. It is constructed in the works of Stoewer Brothers, of Stettin, one of the oldest firms in the motor car industry, who, as far back as 1900, devoted attention to motor vehicles for industrial purposes. In the German War Office trials, the 5-ton model—the plan of which we reproduce—went through one of the greatest tests ever held in any part of the country. It traversed mountainous country at the rate of 60 miles a day for one month without an involuntary stop or a hitch of any description, the lorry being fully loaded. The following is the brief specification: 30-60-H.P. engine, 4-cylinders, 125 mm. by 150 mm., cylinders cast in pairs. The cam shaft and cams are made in one piece out of a solid slab with large bearing surfaces. The engine is fitted with a half-compression cam for easy starting, and also with an automatic governor for a speed of 12 miles per hour, which cannot be tampered with by the driver. The lubrication is by pressure from a rotary pump. Efficient cooling is ensured by means of a centrifugal pump, working in conjunction with a radiator of ample dimensions of the multiple-plate type. Bosch high-tension magneto ignition of the enclosed pattern is fitted. The throttle control is by means of a hand lever fitted to the steering wheel and a foot-accelerator working in conjunction therewith. The clutch is of leather-faced cone type of large diameter, so arranged that it can be adjusted or removed without any other part being dismantled. The gear box is separate from the differential, and connected by cardan shaft, the gear box being suspended on three points. It has four speeds forward and reverse, operated by gate change and selector rods, the top speed being direct drive. The final drive is by extra large chains. The general dimensions of the chassis are, overall length, 21 ft. 2 in., overall width, 6 ft. 7 in., wheel track, 5 ft. 7 in., wheel base, 14 ft. and the weight, 3½ tons. The chassis exhibited was sold during the show and two repeat orders were taken.

Avon India Rubber Company, Limited.—Avon band tyres in the half-round and special "B" sections suitable for all classes of industrial vehicles were displayed. The "B" section tyre has been designed to withstand the severest conditions, and is particularly suited for heavy haulage work. The Avon "Grip" pattern solid tyre is suitable for light delivery vans. The quality of rubber in these tyres makes them both hard wearing and resilient.

Dook-Swain Tyre and Rubber Company.—The "Hercules" band tyre was shown in various sizes and sections. As these tyres have had a most successful record on public service vehicles, both petrol and steam, they are naturally in demand.

The Dunlop Rubber Company, Limited.—In addition to a full range of band tyres of various sizes and sections, this exhibit included discarded tyres which had covered high mileages. The solid band tyres were suitable for motor lorries, chars-a-bancs, and motor omnibuses with a carrying capacity up to 12 tons. Heavy wood wheels, also suitable for public service vehicles, were shown, together with tyring for cabs and carriages, rubber matting, etc.

J. W. and T. Connolly, Limited.—The Connolly band tyre was displayed in all sections and sizes from 65 mm. to 160 mm. and suitable for all loads. A special feature was made of a 160 mm. section for steam wagons for winter only. The "Connolly" detachable wheel, which has special novel features, was also shown. It is suitable for heavy vehicles, and its special construction enables the user to fit the tyres in position without the aid of the hydraulic press.



Elevation and Plan of Stoewer 5-Ton Chassis.

Peter Union Tyre Company, Limited.—Solid tyres of all patterns and sizes occupied the major portion of the available space here. These were of types suitable for the lightest delivery van up to the heaviest of the petrol and steam vehicles. Several pneumatic tyres were also shown, many of which, with their heavy treads, were suitable for the lighter industrial vehicles.

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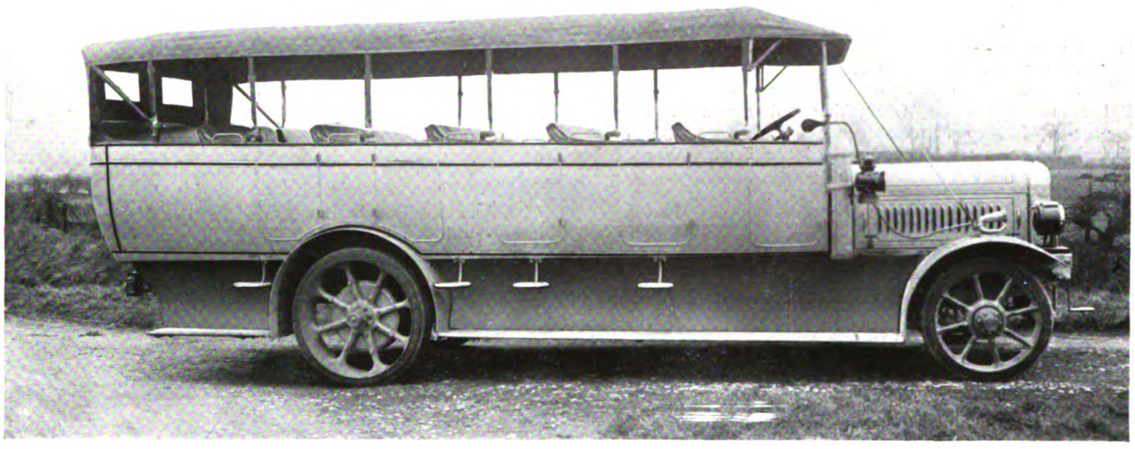
MOTOR TRAFFIC.

Leyland Motors, Limited.—The exhibits comprised a wide range of vehicle, and visitors were afforded an excellent opportunity to examine the various models for which the works at Leyland have become famous. Prominent was a powerful motor fire engine of a new type, built to the order of Hobart, Tasmania. It was fitted with a 55-H.P., and carries a Ries turbo pump having a delivery capacity of 450 gallons per minute at a pressure of 120 lbs. The machine was fitted with the War Office special type of back axle. A large torpedo shaped chars-a-banc attracted attention. It was fitted with a 45-H.P. force feed engine, single tension ignition, and Chandel-Hobson carburettor. It was upholstered in green, and fitted with wind screen and cape cart hood. The seating arrangements were for 27 passengers and driver. The 4-ton lorry shown was fitted with the same type engine as the chars-a-banc, and was arranged for a bevel drive on the back axle. The platform loading space was 14 ft. by 6 ft., and there was a hand shield extension to the dash board fitted with side doors. Two other models were a 3-ton lorry, and a 1-ton special van, the latter being the 18th repeat order from Messrs. W. and R. Jacob. Each model was fitted with the A.T. speedometer, which is giving satisfaction on all types of commercial vehicles.



Leyland Touring Car.

Lacre Motor Car Company.—An exceptionally handsome chars-a-banc was shown on this stand. The vehicle was luxuriously upholstered and fitted with cape hood and wind screen. The engine was the Lacre 4-cylinder 38-H.P. standard type. A second exhibit consisted of a 20-H.P. 4-cylinder chassis suitable for loads of 25 cwts. This chassis afforded an excellent opportunity for visitors to note the simplicity and accessibility of the Lacre vehicles, features which are rapidly gaining for them favour in the public service field.

Lacre Touring Car for Public Service.

Austin Motor Company, Limited.—This firm, who are makers of the majority of the large fleet of private hire vehicles run by Thos. Tillings, Limited, had two models on view. One was a 15-H.P. 4-cylinder ambulance van, and a 15-H.P. 4-cylinder van. The former was fitted with a special type of chassis with the engine under the driver's seat, in order that the greatest possible space should be available for the body, the wheel base being 9 ft. 7 in. The feature of the light delivery van is speed and the special steering gear, which renders it particularly suitable for town traffic.

Coventry Chain Company, Limited.—Here were a large variety of roller and noiseless chains suitable for all kinds of road drives and for general engineering purposes. The chain-driven change-speed gear box, which has proved such a success on the London General omnibuses, as well as on the Daimler company's vehicles, proved a constant attraction.

Polack Tyre and Rubber Company, Limited.—As usual, the company were represented by Mr. Leo Swain, their Manchester representative. The exhibit embraced a full range of solid tyres, with carrying capacity up to 12 tons; and special attention was called to the show of discarded tyres as evidence of the many splendid mileage records which had been set up over all kinds of roads. These showed that whereas the guarantee was for 10,000 miles, that total was largely exceeded. In some instances 16,000 to 20,000 miles had been covered. A large sample of the finest Para rubber from which the tyres are made formed an interesting exhibit.

SATISFACTORY WORKING OF BATH TRAMWAYS MOTOR OMNIBUSES.

Sir James Sivewright, in the course of his remarks from the chair, at the annual meeting of the Bath Tramways Company on February 27, said he was glad to say that although the company's motor 'bus traffic had had to meet competition the traffic had been of a very satisfactory character and was full of promise. Along with Mr. Clutterbuck, the resident director, and Mr. Trenow, the managing director, he had had interviews with public bodies in the city, who had expressed themselves as being highly pleased with the manner in which the company were meeting the requirements of Bath and making it attractive as a health resort by giving facilities for pleasure trips in their motor cars. The company had maintained their tramways, motors, and foundry in a position second to none, and were carrying forward £3,200. They have paid off £5,000 debentures, and placed £10,000 to renewal and contingency account, having thus an available total of £18,000. The sum of £3,200 would be carried forward pending the completion of arrangements which were being made for meeting the bank loan standing in the balance sheet at £21,150. When those arrangements had been completed they would be able to pay a dividend on the preferred ordinary shares. The past year had produced increased receipts amounting to £2,163.

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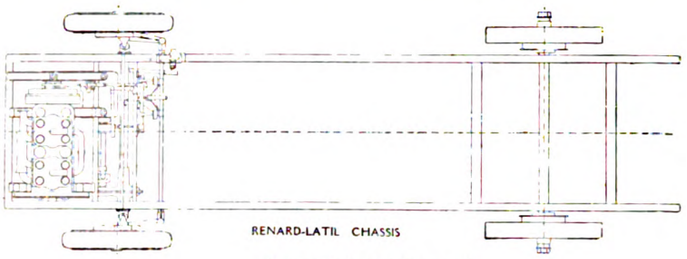
MOTOR TRAFFIC.

FRONT-WHEEL-DRIVEN VEHICLES.

A Leading Feature at the Manchester Show.

If for no other reasons than the prevention of skidding by front-wheel-driving and braking, greater durability of chassis and tyres, and the opening up of the heaviest branches of transport to motor traction, the Renard-Latil front-driven commercial motor vehicles are to be welcomed. The last-mentioned consideration is of great importance in some departments of transport associated with municipal work, notably water and other carts. At the Manchester and Northern Counties' Show of industrial and commercial motor vehicles last month this new departure in motor vehicles on the British market constituted one of the most attractive features of the Exhibition. Moreover, the invention is not an untried one, for it has undergone the test of over eight years' work in France, where three types of vehicles constructed on this principle secured the Grand Prix d'Honneur, each of the trio taking a first prize, and beating previous fuel consumption records. Last year, too, four Renard-Latil commercial cars passed the French War Office trials for the Government subsidy.

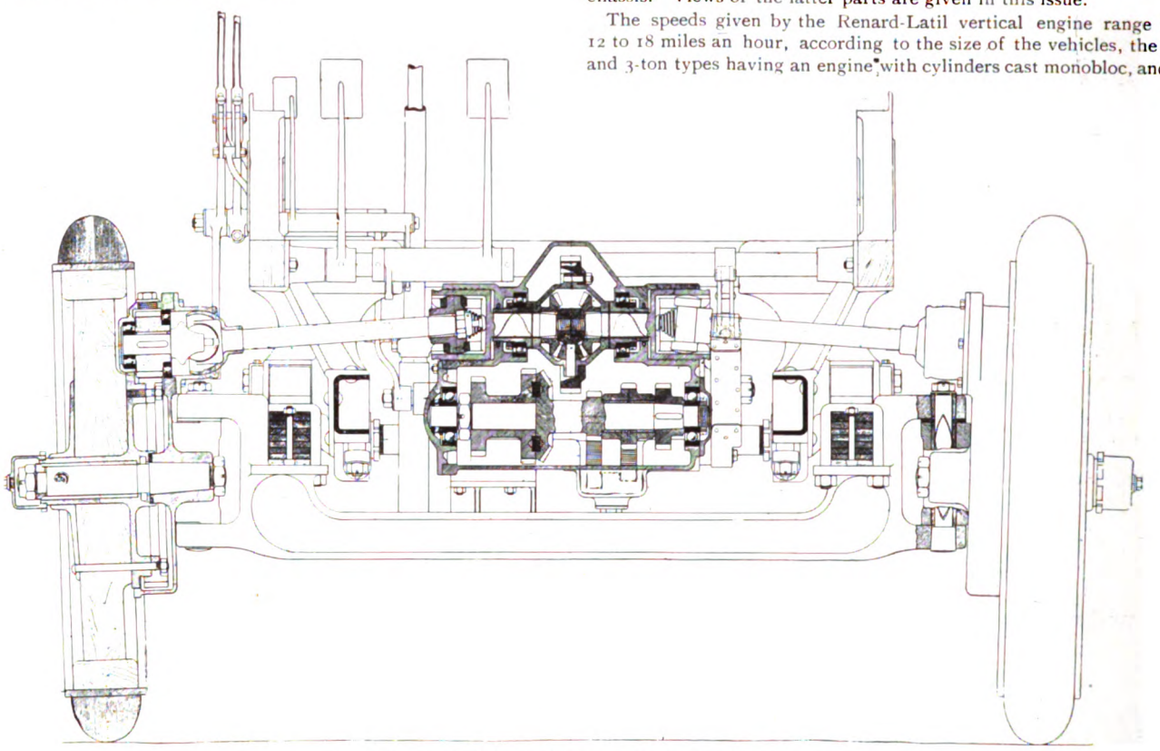
In this country they have been introduced by the Renard Commercial Motor Company, Limited, 82, Victoria Street, S.W., who were the exhibitors at Manchester, the manager of the company being Mr. G. Massy-Bernside. Two complete vehicles were exhibited, one being a 5-ton 30-H.P. lorry, with special low chassis, and a 2½-ton 25-H.P. tipping wagon, fitted with a steel body. A sectional exhibit



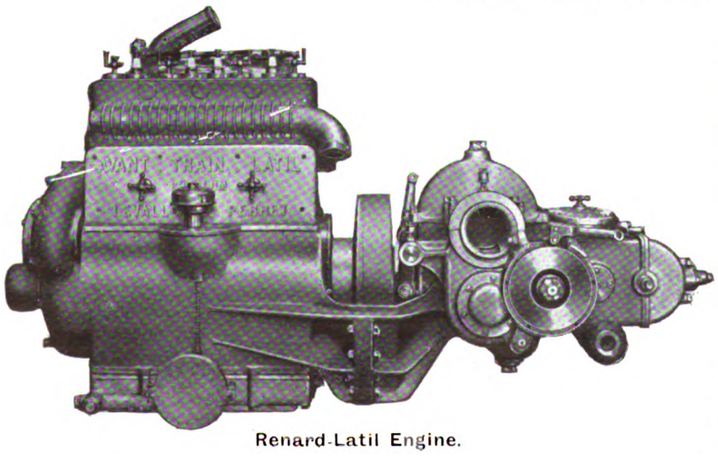
Renard-Latil Chassis.

was the engine, transmission, front wheels, and steering gear of a 3-ton chassis. Views of the latter parts are given in this issue.

The speeds given by the Renard-Latil vertical engine range from 12 to 18 miles an hour, according to the size of the vehicles, the 1, 2, and 3-ton types having an engine with cylinders cast monobloc, and the



Cross Section of Renard-Latil System.



Renard-Latil Engine.

4 and 5-ton types having the cylinders in pairs. The petrol consumption is equal to that of other types of vehicles of similar carrying capacities, the carburettor being of a much improved automatic type, which ensures perfect combustion at all engine speeds. Ignition is by a high-tension magneto. Only the best specially-selected close-grained iron is used in the construction of the engine, and ample water jacketting is provided for cooling. The crank case is of bronze, the lower half acting as an oil retainer only, and being easily removed for inspection. The crank shaft is of the finest chrome nickel steel, and the valves are of the poppet type, operated by adjustable tappets. Lubrication to all working parts is automatic, the pumps being driven indirectly from the crank shaft.

Power from the engine is transmitted through a specially-designed leather cone clutch to the gear box, which provides a direct drive on the top speed. The bringing of the drive from the gear box direct on to the front wheels is achieved by means of a differential placed in the longitudinal axis, and two universal joints working at a constant angle. Special

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attention has been given to the design and selection of material for the axles, the front one being a solid steel forging of extra strength.

Appended is an outline of the advantages claimed for the Renard-Latil front-wheel-driven vehicles.

RUNNING EMPTY.—Take the rear axle of any ordinary type motor vehicle designed to support a weight when loaded of five tons. When empty, the weight on the rear axle is probably about 15 to 20 cwts., and consequently the springs, elastic under the full load, cease to perform their functions when the vehicle is running unloaded. The result of this is that the mechanism of rear-driven vehicles is constantly working under irregular conditions, thereby shortening the life of same. With the Renard-Latil, by reason of the entire mechanism being arranged in front, where the springs carry a fairly constant load and are always elastic, this drawback is entirely obviated, and the vehicle can be driven empty without the slightest damage to the mechanism.

DEFORMATION OF CHASSIS.—The chassis of commercial vehicles undergo constant deformation when travelling, due to the unevenness of the roads and the distribution of the load. The driving parts, therefore, cannot remain in the highest working condition for long, owing to the strain thrown upon them by such uneven running and distortion of chassis. With the Renard-Latil, owing to compactness of mechanism and the complete absence of long cardan shafts or chains and counter shafts, as the case may be, the driving parts are always working under the best conditions.

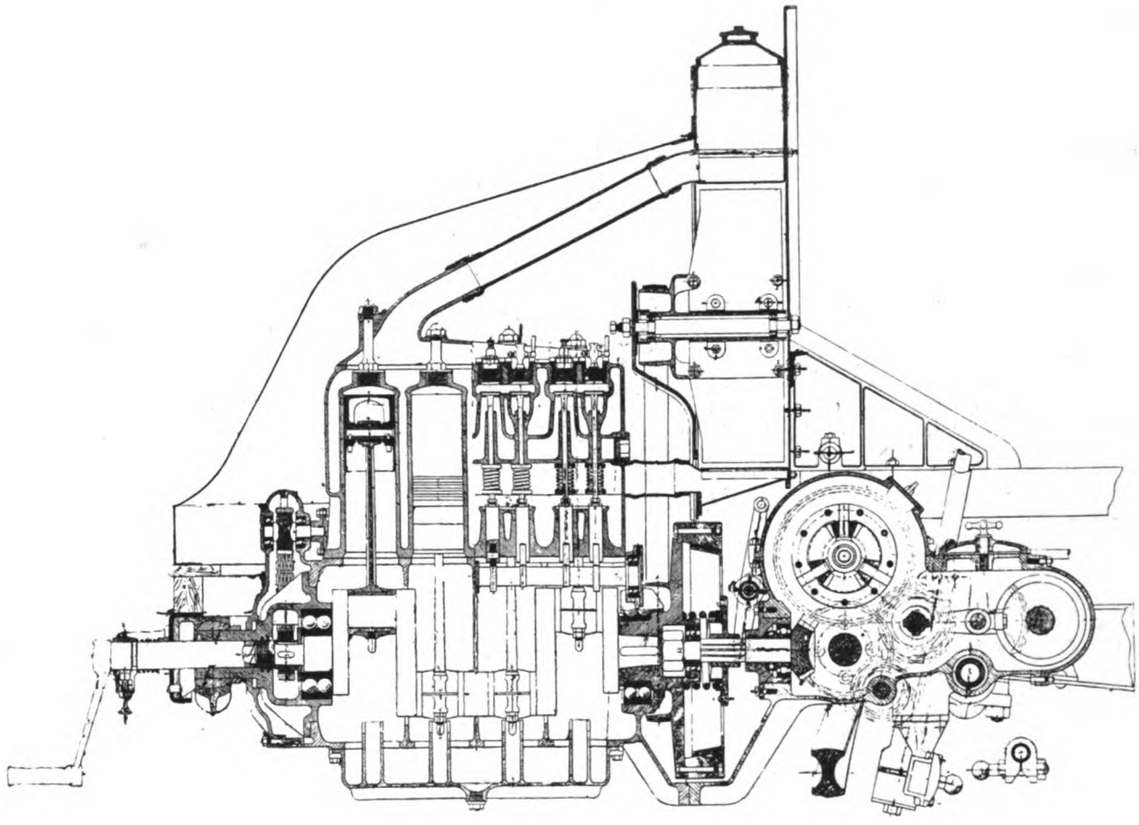
ACCESSIBILITY.—The distribution of mechanism under the bodywork of commercial vehicles makes it very difficult of access. In the event of repairs or replacements, considerable cost is entailed in dismantling the chassis. With the Renard-Latil, every part of the mechanism is readily accessible, consequently, it is more likely that the working parts will be frequently examined and kept in proper condition, because this can be done without much effort and without an inspection pit. Repairs or replacements can be carried out with the minimum of delay and cost, because they are all under the bonnet.

BRAKES.—With ordinary type commercial vehicles, the brakes act on the rear wheels. The Renard-Latil has brakes on all four wheels, thus equally distributing the strain and permitting of much quicker stopping and greater safety both of driver and vehicle. The front brakes of the Renard-Latil act through the driving mechanism, and those at the rear on drums attached to the wheels, on the 4 and 5-ton models; if steel tyres are fitted the brake acts direct on tyres.

SKIDDING.—In the event of a rear-driven vehicle skidding on greasy road, it is often extremely difficult to recover the steering because the rear wheels are pushing the van straight in front of them. With the Renard-Latil the reverse is the case, because the front wheels are pulling, and so it is easy to recover the steering should a skid occur, which is unlikely.

BODYWORK.—In the case of rear-driven vehicles it is impossible to fit low bodies on account of the presence of the driving mechanism at the rear. With the Renard-Latil, bodywork can be built almost to the ground because the rear part of the chassis is entirely free of mechanism. This is an advantage of the greatest importance.

TRANSMISSION.—For the transmission of the drive in the case of rear-driven vehicles, chains have in many cases been adopted, because it has been found that the long cardan shaft cannot be made sufficiently strong to withstand the tremendous strain of transmission on heavy-weight vehicles. With the Renard-Latil the transmission is very short and at a constant angle, making it possible to use a cardan shaft without any of the drawbacks associated with rear-driven vehicles.



Sectional View of the Renard-Latil Engine.

REFUSE WAGONS FOR GLASGOW.—The Corporation have placed orders for two motor wagons, for the transport of refuse, with the Belhaven Engineering Company and G. Gilmour, Limited.

LANCASHIRE TRADERS' COMPLAINTS OF THE RAILWAYS.—Considerable discussion has taken place in the Manchester newspapers concerning suggestions made for the conveyance of goods between outlying towns and the Ship Canal Docks by other means than the railways. One prominent trader declares that complaints are of no avail in getting redress or improvement, and it is becoming pretty obvious that the district is suffering from the effects of economies in the traffic departments of the railways, and not from temporary or isolated dislocation of the traffic arrangements.

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BRISTOL TRAMWAYS MOTOR TRAFFIC.

THE EFFECT ON THE COMPANY'S RETURNS.

The importance of the petrol motor vehicle business, which has been developed by Mr. C. Challenger, the general manager of the Bristol Tramways and Carriage Company, was shown in the speech made by Sir George White from the chair at the ordinary general meeting on February 19. The new department was instituted in January, 1906, and in addition to carrying passengers on city routes, the company possess a large pleasure traffic as well as extensive postal and commercial vehicle contracts. The chairman stated that the company's revenue for the past year was £369,614, made up of tramway receipts, £230,540; motor carriage department, £133,745; and sundry, £5,329. The tramway receipts showed an increase of £5,390, or 2½ per cent., and the motor carriage department, £27,666, or 26 per cent. increase. The expenditure was £301,412, an increase of £30,838 over that of the preceding year. Amongst the items of increase were £12,000 in wages; of this, however, £3,000 was represented by some levelling up of lower-paid hands, and the bonus for long service introduced last year as as additional incentive to the men who remained in the service for long periods. Provident, medical, and superannuation benefits have involved an extra charge of £2,000, being £4,800, against £2,800 last year. The tramway traffic was the least encouraging. They worked at very low fares on a series of severe gradients. Tramway profits per passenger were microscopic; $\frac{1}{100}$th of a penny per passenger in Bristol meant £2,000, so that people who talked of reducing fares little knew how they would jeopardise the whole undertaking. The reduction of a farthing per passenger would sweep away every penny of profit that went to pay interest and dividend on the one and a half millions of capital invested in the tramways department. Twelve per cent. of the traffic was at workmen's fares, which on an average worked out at three-tenths of a penny per mile only, some of the longer sections being less than a farthing per mile. In nine years the volume of the whole tramway traffic had only increased one per cent. per annum, although concurrently there had been brought in all the extra traffic on the extensions, on the development of which in that period they had spent additional capital approximating to £150,000.

Happily the past year's percentage of increase, though small, was better than in some years, and this result was due to the care with which they had nursed the tramway traffic, by arranging motor 'bus routes to feed the tramways. But for this policy the tramways must have continued to show the decrease which started a few years ago. In some cities motor 'buses were used in competition with, and were seriously cutting into, tramways; hence, he supposed, arose the misconception of one of the local dailies, which actually commented on the directors' report in these words: "It is remarkable that in spite of the motor 'bus system that has been promoted by the company with splendid energy and astuteness the receipts from the tramways show an increase of 2½ per cent." He feared the paper in its reference to "astuteness" had accepted too readily irresponsible chatter of some people who suggested these 'buses were a deeply-laid scheme to produce a certain effect. If the directors thought it right to adopt such a course, did they think the man in the street would be long in doubt as to what was happening? No, the company's business was to serve the public with every agency at their command, and, as he had often told them, it did not matter what form of traction was for the moment the most acceptable, they would use it, though the fact that they had a huge capital embarked in tramways, to say nothing of the natural feeling of sentiment, seeing they were the apostles of tramways, would always ensure their making the best of their lines, and giving the public the maximum of convenience all round.

The motor carriage department was progressing in a marvellous manner, and presented great scope for future development. They were preparing for a large business, as the reference in the report to the new motor building works would have indicated. The directors had given an immense amount of study to the laying out of those works. In June next they would invite the shareholders to meet the directors at the new Brislington works, and inspect the process of manufacture and repair carried on. They would leave the place impressed with the importance of the policy the directors were adopting, and the efficiency of the means taken to secure a success. At no distant date the additional profits from the motor department would come to be added to those already being made in that department, and these, supplementing the tramway profits, would together yield a more satisfactory return for the capital invested in the undertaking. He moved that the directors' report and accounts be received and adopted, and that a final dividend at the rate of 4 per cent. per annum for the past half-year be declared, and that the balance be carried to the reserve fund

"TARFLUX" SPRAYING FOR ROADS.

A numerous assembly of road surveyors visited Chiselhurst, Kent, on February 19, to witness the treatment of two stretches of road, in and adjoining Holbrook Lane, with "tarflux." Under the auspices of "Tarflux" Roads, Limited, whose works are at Nottingham, and their commercial office at 122, Victoria Street, London, the utility of the invention has been proved for two summers past, and a company has been formed to extend the sphere of operations in this and other countries. Fine weather favoured the demonstration, for which an ordinary water cart fitted with a mixing apparatus was used. The vehicle was filled with 40 gallons of "tarflux," which is a chemical compound, 150 gallons of water, and 80 gallons of tar.

Important points to be considered in connection with this mixture are that the tar used is cold, no roadside heating being required, and the materials used can be mixed in the proportions by any labourer. One horse and distributing cart, with two men, can spray five miles of the compound in ten hours. The mixture is non-inflammable, non-poisonous, and except in special cases it does not require gritting after it has been distributed. Beyond levelling and watering no special preparation of the road is required, and the spraying does not make the surface greasy and slippery as is the case with plain tar.

Heavy traffic can be allowed on the road treated shortly after the completion of the spraying. Testimony has been borne to the efficiency of "tarflux" as regards dust prevention and surface preservation by the surveyors of Godalming, Guildford District Council, Bolsover Urban Council, and Newark Corporation, in which localities there is heavy motor traffic. The views of the Bolsover surveyor are worth quoting: "My own opinion of this winter dressing has materially changed since I wrote you rather hastily that I preferred our own crude tar spraying. From the nature of the flux and its effect upon the roads I have seen treated, I begin to think that it is the material that motorists and highway authorities all over the country are seeking, and I am advising my Council to close with the favourable terms upon which you offer to treat a portion of our roads."

The great objection of subsequent slipperiness which is raised to the spraying of crude tar does not apply to this mixture, which does not cause the surface to become greasy. There is no tar splashing, and motor cars have been known to travel over a "tarflux" sprayed road within twenty minutes of the operation without marking of the tyres. The company state that it is highly probable that there are purposes other than the spraying of road surfaces to which "Tarflux" may be successfully applied, viz., in the place of cement for damp-proof courses, roofing sheds and other temporary erections, and in many other ways where it is necessary to keep out atmospheric moisture, and that successful experiments have been made in connection with fire proofing coverings, for boilers and steam pipes, timber, railway sleepers, telegraph poles, roof-felting and other inflammable materials.

WOLSELEY CARS FOR LONDON FIREMEN.

At the meeting of the London County Council on February 11, a report from the Fire Brigade Committee in regard to motor cars for the use of superintendents in the fire brigade was adopted. On July 23 last the Council decided to obtain four 12-16 H.P. motor cars for the use of superintendents in place of visiting traps. The chassis of the cars were supplied by the Wolseley Tool and Motor Car Company, at £250 each, and the bodies were supplied and fitted by R. Harrison and Sons at £22 10s. each, while the tyres and other accessories were purchased at the lowest prices obtainable and fitted to the cars in the brigade workshops. At that time the committee pointed out that seven motor cars would eventually be required. It was desirable that all the seven cars should be of the same type, with all parts interchangeable. The company were willing to supply the chassis at the same price as before, and it was understood that R. Harrison and Sons would supply and fit bodies at their former price. The estimated cost of each complete car was £330. The committee accordingly proposed that the three additional cars should be obtained on the terms mentioned. The committee further pointed out that at each of the superintendents' stations a horsed steam fire engine had been, or would be, displaced by a motor fire engine, and that in each case, unless a motor car was obtained for the superintendent, it was possible to dispense with one horse only instead of a pair of horses. By providing a motor car, therefore, the cost of horse hire was reduced by about £65 or £70 a year in each case.

MOTOR OMNIBUS SERVICE FOR MONTREAL.—It is stated that 100 vehicles are now in course of construction in France for the motor omnibus service which is to be inaugurated in Montreal in June next.

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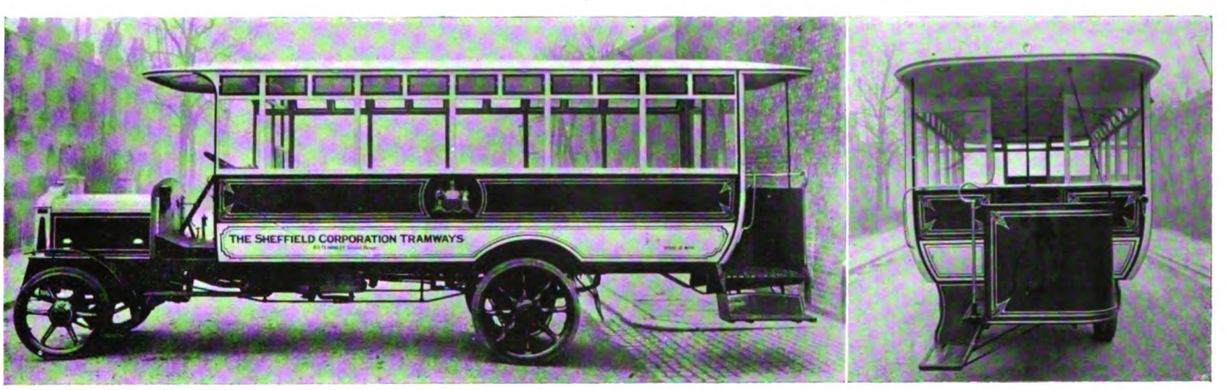
SHEFFIELD'S USE OF THE MOTOR OMNIBUS.

Mr. A. R. Fearnley, general manager of the tramways department, in giving the fifth of a series of lectures on public health work in Sheffield, which are being given in that city, dealt with the work of the tramways department. He pointed out that motor 'buses, which had not to lay out capital on overhead wires, were serious competitors. In the city's Parliamentary bill powers were sought to work trackless trolley vehicles or motor omnibuses, and the question to be decided was whether they were to be used for suburban work or testing suggested tram routes. In the tramway world it was almost considered heterodox to suggest the running of self-controlled vehicles, but the motor omnibus had made such strides that he had already taken the risk of advising that motor omnibuses should be used for testing routes. How far motor 'buses would come to be used in place of tramcars with their necessary track remained to be seen. He intended to profit by the experience of a friend who, at the Municipal Tramways Conference in London in 1909, prophesied that in 20 years tramways would predominate, and rare specimens of an extraordinary vehicle called a motor omnibus would be found in South Kensington Museum.

Appended are illustrations of one of the single-deck omnibuses which the Daimler Company have supplied to the tramways department of the Sheffield Corporation. The chassis is the Daimler standard, fitted with the Knight 40-H.P. engine and silent chain change-speed gear box, exactly similar to those of the double-deck vehicles supplied to the M.E.T. Omnibus Company, and which were last month placed in service between Finchley, Hendon, and London Bridge. The bodies of the Sheffield omnibuses are arranged to give seating capacity for 25 passengers inside, all the seats being of the cross type and fitted with leather spring cushions. The backs are of the lath and space type. As will be seen from the illustrations, the vehicles present a most pleasing appearance, and they are painted and lined in the Sheffield Corporation colours. The body, which represents an excellent example of the coach builder's art, were constructed by Christopher Dodson, Limited, of London, a firm with over 60 years' experience in public service coachwork.

It was reported at a meeting of the City Council on February 12 that the Heeley Ward Citizens' Association had protested against the decision not to run a motor omnibus service to Heeley Green. Sir William Clegg, chairman of the Tramways Committee, stated that the Daimler omnibus service to Lodge Moor had been so satisfactory that they had decided to purchase two more omnibuses, and they were proposing to institute a penny ride between Crosspool and the bottom of Manchester Road, in addition to the threepenny ride to Lodge Moor. They hoped to have a regular service in operation before the summer started.



Daimler 40-h.p. Omnibus for Testing Routes at Sheffield.

HALLEY'S INDUSTRIAL MOTORS.—This company has declared a dividend at the rate of 20 per cent. per annum on the paid-up capital for the half-year ended December 31, thus bringing the total dividend for the year up to 15 per cent.

A CHESTER COMPANY'S ENTERPRISE.—The Crossville Motor Company, of Chester, have established a motor omnibus service between that city and New Ferry, which is proving a great convenience to the residents in the intervening places on the route of 13 miles. During the past two years a service has been run from Chester to Ellesmere Port. Lacre vehicles are used on the new route.

FROM MANCHESTER TO LONDON.

During the Manchester Motor Exhibition, Messrs. W. A. Stevens, Limited, ran one of their latest 40-H.P. Tilling-Stevens petrol-electric omnibuses for demonstration purposes, and it was ridden in and inspected by a large number of visitors. The original idea was to run the vehicle in a service between the commercial motor show and the pleasure car show at Rusholme. Owing to police regulations, however, this was not allowed. Full advantage was taken of the presence of the motor omnibus in Manchester, and a number of most interesting test journeys were made both by Corporation officials and others with a view to obtain information with regard to its capabilities. Our photograph shows the 40-H.P. Tilling-Stevens omnibus returning from Manchester to Maidstone. The view was taken in the Peak district on the main road between Manchester and Sheffield, just after the 'bus had completed a climb of 1,700 ft. The whole journey was made very successfully, and at no part did the speed fall below 12 miles per hour.

Tilling-Stevens Petrol-Electric Demonstration Omnibus.

LONDON GENERAL OMNIBUS COMPANY.

The report for the period from June 21 to December 31, 1912, shows the balance at credit of revenue account, £122,037; interest and dividends on investments, etc., £20,645; total, £142,682. After deducting for interest on 4½ per cent. debenture stock £18,750, and for interest on 5 per cent. cumulative income debenture stock £20,833, there remains a balance at the credit of profit and loss account of £103,099. The directors recommend the payment of a dividend of 8 per cent. on the shares of the company, which will absorb £92,038, leaving £11,061 to be carried forward. On December 31 the company owned upwards of 2,250 omnibuses and 30 garages. The company has contracted for a sufficient supply of petrol for a further period of two years, but at a substantial increase in price. The directors deplore

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the prevalence of accidents, and are giving the subject their most careful consideration. An approved society has been formed under the National Health Insurance Act, 1911, in which there are 11,150 members. A scheme providing for superannuation of employees in certain grades came into effect on August 1. The number of passengers carried by the London General Omnibus Company and the receipts are given in the recently issued report of the Underground Electric Railway Company. We append also in the right hand column the average fare per passenger.

Period to	Passengers.	Receipts.	Average Fare per Passenger.
Jan. to June 30, 1912 ..	221,032,378	£1,217,207	1·3215d.
July to Dec. 31, 1912 ..	266,169,251	1,467,122	1·3229d.
Total	487 201,629	£2,684,329	1·3223d.

Mr. C. Cater Scott, presiding at the annual general meeting on February 18, said that it was difficult to make a comparison with any previous period. The company had entered into working agreements with several omnibus companies. The working of all the 'buses by one company was of special advantage to the public. Overlapping services were avoided, and 'buses were placed with regard to the territory to be served as a whole rather than unduly congesting the more densely populated routes. The proceeds from the sale of stocks (£1,845,000), after providing for the purchase of the old London General Omnibus Company, was sufficient for the needs of the company for some time to come. Some comments had been made in regard to the goodwill, which stood in the balance-sheet at £417,067. When buying a company whose shares stood at a high premium, it was almost inevitable that the price paid must exceed the intrinsic value of the assets, and so it was when the old company was sold to them. The directors recognised that this item, as well as the preliminary expenses and discounts on issue of debentures had to be dealt with, and they would be prepared in due course to consider the best means of writing off these amounts. It might be suggested that the £85,000 reserved for depreciation upon the motor 'buses was too large when it was remembered that the 'buses were always maintained at a very high standard, all of which was charged direct to maintenance. But, in view of the past experience, it was prudent to be on the safe side. It was their intention to provide a motor 'bus of the very latest type, and, in order that the company might be prepared for any improvements, it was desirable that sufficient reserve funds should be laid aside. Many new services had been opened up, and it was only right to state that it was doubtful if the earnings per individual 'bus would ever again equal those of previous years, when the traffic was largely centred upon the most remunerative routes only.

MOTOR TRAFFIC NOTES.

The System of Traction for Krugersdorp.—To establish a tramway system at Krugersdorp (Transvaal) would, it is estimated, cost £45,000. The city engineer has presented an alternative scheme for motor omnibuses.

Result of Competition in Outer London.—Ilford Tramways Committee have recommended the Council to apply for general powers to purchase and run motor omnibuses in preference to extending the tramways or installing railless trolley cars.

Berna Three-and-a-Half Ton Lorry.—In a notice of this lorry in our issue of February 6, a typographical error occurred in the statement of the consumption of lubricating oil on a special test. The figures should have read 219 miles to the gallon.

Maudslay 4-ton Chassis.—The latest purchasers of the Maudslay industrial vehicle are Lever Brothers, Limited, of Port Sunlight, who have recently placed an order for 12 4-ton Maudslay chassis. The Maudslay Company advise us that the delivery is to be the quickest obtainable at the present time.

Sequel to the Glasgow Carters' Strike.—As the result of the strike of horse carters recently entered upon at Glasgow, the local motor cartage firms have done good business, and motor manufacturers have received a number of enquires from local owners who have not relished the expense of keeping their horses idle.

Proposed Omnibus Extension of a Railless Trolley Installation.—Owing to the refusal of the Aberdeen Harbour Commissioners to consent to an extension of the Footdee railless trolley route, the Tramways Committee propose to recommend the purchase of several petrol electric omnibuses at £850 each.

Railless Trolley Cars or Motor Omnibuses for Aberdeen Suburbs?—The directors of Aberdeen Suburban Tramways Company have been considering as to the extension of the company's business, either by the use of motor 'buses or by cars run on the railless trolley system, and they hope before long to be able to submit formal proposals. It has been locally stated that the selection of the system will depend upon the price asked by the Corporation for the supply of current.

A Cautious Tramway Chairman.—In reporting to the Plymouth Council on February 17 on the Municipal Tramways Association Conference, Councillor Stephens, chairman of the Tramways Committee, referring to the question of motor 'bus competition with tramways which was discussed by the conference, suggested that as the Council had the right not to allow motor 'bus traffic in Plymouth, they should be very cautious in granting licences which would tend to take away the prosperity of their own tramways.

The Price of Petrol.—On February 25 an advance of 2d. was announced in the price of petrol, making the retail price 1s. 9d. per gallon. A new grade of heaver spirit has been introduced by one of the distributing companies at 1s. 7d. per gallon. The ninth week of the motor cab drivers' strike, which is due to the price of petrol, was completed on March 1. A proposal has been made from the men's side for the adoption of a mixture of petrol and paraffin. The total capital invested in London in the motor cab industry is about £3,000,000, of which the capital of the associated companies amounts to £2,000,000.

L. and S.W. Railway Company and Motor Omnibus Powers.—Exeter City Council have decided to present a petition against that portion of the L. and S.W. Railway Company's Bill which proposes to give the company powers to run motor omnibuses. Should the clause not be withdrawn, Sir G. Baring, M.P., is to be asked to block the bill in the Commons. The Tramways Committee consider that the clause is likely to be prejudicial to the tramway undertaking, and that it would also affect the Council as the road authority of the district. Plymouth and Bath Corporations also intend to oppose the clause, and petitions against it are also to be presented by Surrey County Council and many of the local authorities of the county on grounds connected with road maintenance.

Hove's Preference for Omnibuses.—The annual report presented at the general meeting of the Hove Ratepayers' Alliance, expressed the opinion that if the Hove Council had followed the advice given to the Alliance, that Hove's Trolley Traction Bill should be withdrawn and the Brighton Blll opposed so far as it related to Hove, the railless trolley system would not have been allowed to be introduced into the borough. So far as was known, the Board of Trade had not yet granted the licence for the running of trolley 'buses on the east and west route, and the committee of the Alliance would continue to do all in their power to prevent the introduction of railless trolleys into Hove, being convinced that a proper system of practically silent motor omnibuses was all that was needed. The proceedings in Parliament cost the town £6,000.

Rotherham Tramways Committee Impressed by a Motor Omnibus.—Through the courtesy of Mr. A. R. Fearnley, general manager of Sheffield Tramways, the 40-H.P. Daimler motor omnibus, recently purchased by that department, was utilised to convey a number of members of Rotherham Corporation for a ride from Rotherham to Thorpe and Scholes. Mr. Fearnley and Mr. E. Cross, Rotherham electrical engineer, accompanied the party, whose object was to judge of the suitability of such a vehicle for providing communication between those districts before installing railless trolley cars. Alderman Winter, chairman of the Tramways Committee, remarked that the easy running of the vehicle had surpassed his expectations. Two motor 'buses are likely to be purchased The Corporation possess powers to run them within the borough, and to several places outside with the consent of the local Councils.

Dunlop Rubber and Tyre Companies.—Mr. Arthur du Cros, M.P., presided at two ordinary general meetings of the Dunlop Companies, held on February 19. The dividend of the Dunlop Rubber Company was 12½ per cent. In moving the adoption of the report, Mr. du Cros said the amalgamation of the trading interests of the company with those of the Tyre Company had tended to the consolidation of the business upon more sound, more secure, and, he thought, more profitable lines. At the meeting of the Dunlop Pneumatic Tyre Company, Mr. du Cros pointed out that the amount for distribution was £131,000. A dividend at 10 per cent. on the ordinary shares was ordered to be paid. At a special meeting it was decided to change the name of the company to "The Parent Tyre Company, Limited." Mr. du Cros suggested that it was a very proud title because it signified every other tyre company in the world, great or small, wherever it might be, owed its existence to the initiative of this company.

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THE Tramway & Railway World
A REVIEW OF CURRENT PROGRESS IN ELECTRIC AND OTHER TRACTION

ESTABLISHED 1892. LONDON, APRIL 10, 1913. VOL. XXXIII.

P-A-Y-E CARS AT LEICESTER.

AN IMPORTANT ROUTE SERVED BY DOUBLE-DECK PREPAYMENT CARS.

On March 19, for the first time in this country, an important tramway route was entirely served by cars arranged on the prepayment system under the patents of the P-A-Y-E Tramcar Corporation, Limited. Leicester Corporation has thus gained the distinction of making use of a new method while other towns have only begun to think about it. The Leicester Tramways Committee have, indeed, had the full courage of their convictions; they have not made an experiment on a subordinate branch line, but have selected one of their routes of heaviest traffic, where nothing but double-deck single-truck cars are in use, and they have adapted everyone of the cars on that service to the P-A-Y-E system. The Board of Trade having for years hesitated to allow tramway passengers to alight from the front of a car have, at length, discovered that such an arrangement, instead of being dangerous, in reality increases the safety of the passengers. Consequently, the first obstacle which the new system had to meet has once for all, it may now be assumed, been overcome. Passengers enter at the rear, pay their fare on the platform to a conductor (who has no need to be anywhere else but in his appropriate place on the rear platform), ascend to the upper deck or enter the lower saloon, while simultaneously other passengers may descend by the front stairway or make their exit by either door and alight from the front or by the left-hand gate of the rear platform. Clearly a sensible arrangement, and one which economises much time. It has already been demonstrated at Leicester that the fares of passengers are collected and tickets issued in exchange with as great rapidity as passengers can enter, and the public interest in the new arrangement, which may be gauged by the attendance at the public opening of the new service (an idea of which may be gathered from the accompanying photograph), has quickly been followed by general approval. There are, as there always will be everywhere, a small minority who object to every change because it is such. The people who belong to this class will quietly submit to have their

Popular Interest in the Inauguration of the P-A-Y-E System at Leicester.

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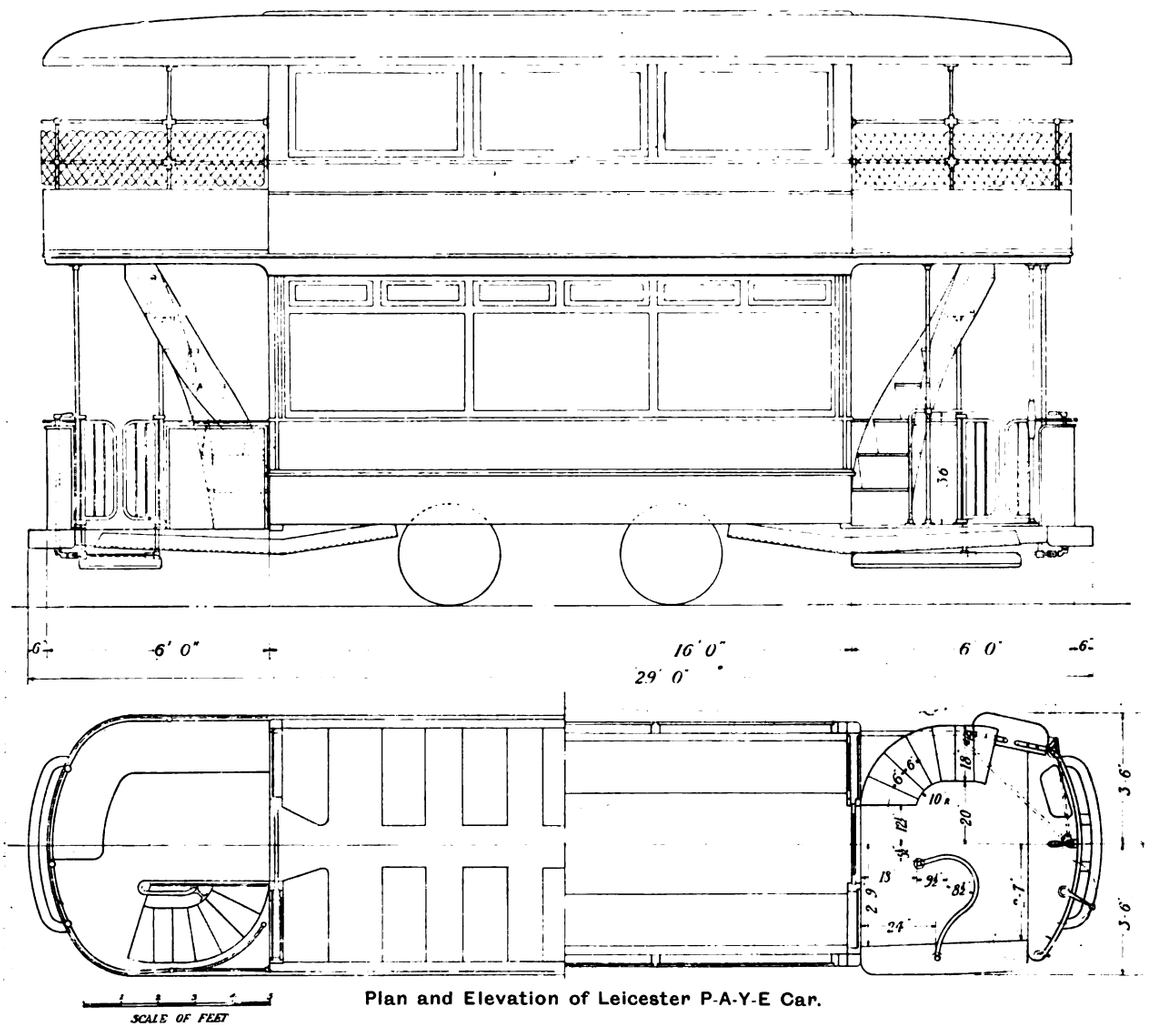
feet trodden upon by the conductor in his unnecessary perigrinations through the car in search of fares, rather than take the trouble to present their fares on entering and so escape any discomfort. Even these people can appreciate the increase in the factor of their personal safety that is the result of both the driver and the conductor always being present on their respective platforms to see that the car is not started at a moment when a passenger is in the act of alighting or boarding the car. From the point of view of the public this is indeed the supreme benefit of the new system. It is not conjectural, but has actually been realised over and over again in town after town where the system has been introduced abroad. The ratio of accidents, fatal and otherwise, to the number of passengers carried has in very many cases been reduced to a surprising extent. It was worth some effort to overcome the inertia of both the public and tramway managements to bring about a change likely to confer such a boon as a substantial reduction in the number of accidents.

To the conductors the new system brings great relief. Their ceaseless errands to the upper deck become things of the past; they have no need even to enter the lower saloon. Their work is done more efficiently on the car platform and with far less fatigue. As one conductor was heard to say at Leicester, after a brief experience with the prepayment system, their task has become "the softest job I ever had in my life." From the point of view of the undertaking, the advantage may not at once be so obvious; but there is the great gain of reduced liability on account of accidents, there is the advantage of improving the conditions under which their employees work, and, lastly, there is the certain prospect of obtaining the fares of all passengers. The exact improvement in this respect will vary with different systems and different routes, but in all cases where traffic is at all heavy a very appreciable increase in revenue is almost sure to result.

Perhaps the greatest factor contributing to the introduction of the system in Leicester was the personal investigation of the prepayment system in America made by Alderman Flint, the chairman of the Leicester Tramways Committee. Alderman Flint came to the conclusion that the system if applied to a British tramway meant a great saving of time, and would be of benefit in many other ways. Its success in Canada and the United States may be judged from the fact that last year over 75 per cent. of the tramcars built in those countries were made under the patents of the P-A-Y-E Tramcar Company.



Plan and Elevation of Leicester P-A-Y-E Car.

In the United States the system has been adopted in 135 cities, and there are 15,000 cars in operation there. Under the most congested conditions of traffic prepayment cars are there operated with 59 per cent. fewer accidents than occur with open cars, and in this respect Leicester affords scope for the management to show what can be accomplished towards reducing the mishaps to passengers, and the consequent expense entailed upon the Corporation by the settlement of claims made for compensation. According to an illustrated leaflet dealing with the new system, issued to passengers by the tramways department, there were as

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many as 450 accidents in that borough during the year 1912, caused through passengers boarding or alighting from the cars whilst in motion.

A thorough trial is being given to the 10 cars on the Narborough Road route, and the inauguration of the system was made under most auspicious circumstances from the tramway centre at the Clock Tower, the open space being literally packed with people eager to witness the despatch of the first car. A municipal party occupied two of the cars, the Mayor and Mayoress (Mr. and Mrs. T. McCall), wearing their chains of office, being the first to pay their fare on the new cars. His worship drove one car part of the way, and the chairman of the Tramways Committee (Alderman S. Flint) the other. During the rest of the afternoon the cars were crowded, and there seemed to be no difficulty in working the new system.

Upon returning to the Grand Hotel tea was served. Among those present, besides those mentioned and many ladies, were Councillor Collier (high bailiff), Alderman Tollington (the deputy-mayor), Alderman Sawday, Alderman T. Smith, Alderman Banton (vice-chairman of Tramways Committee), Alderman Patey, Alderman Windley, Councillors Collier, Reynolds, Holmes, Gimson, and Heath, Messrs. H. J. Buckmaster, L. Charles Huppert (managing director), E. E. Harrison, and A. Frank Paul (engineer), representing the P-A-Y-E Company. Messrs. Mawby (borough surveyor), T. R. Smith (electrical engineer), and A. F. Lucas (tramways manager) were also present.

The Mayor, in opening the proceedings, thanked Alderman Flint for inviting him to preside over that ceremony. He said: This day marks a red-letter day in the municipal work of Leicester. We have inaugurated a new system of fare collecting on our tramways, and I understand that Leicester is the first town in the whole of Europe to install P-A-Y-E double-decked cars. We are proud of the fact that Leicester is an up-to-date progressive town. When we had this system placed before us, we hesitated in accepting it. It is often best to hesitate before making a final decision in matters of this character. But we quickly saw the advantages of the P-A-Y-E plan, and consequently we seized the opportunity of adopting it. Alderman Flint has been responsible to a large extent for the inauguration of the system, and I think the whole town recognises what a capable man we have in the chairman of the committee. Many improvements in the tramway service stand to his credit. I have heard that Alderman Sawday said in the Council Chamber on one occasion that there will come a time when the people of Leicester will be able to ride on the tramcars free of charge. I do not think that time will come. We cannot afford to run our tramcar service on that principle, but we are now offering the public something that will at least afford them decided advantages, which I am confident they will appreciate. It is the custom in Scotland to drink the health of a new undertaking. I propose "The success of the P-A-Y-E system."

Alderman Flint, in responding to the toast, at the outset thanked the assembly, on behalf of the Tramways Committee and the International P-A-Y-E Tramcar Company, Limited, for their presence at the inauguration of the new system. He proceeded: It has been the one aim and desire of the Tramways Committee to make the Leicester tramway service, if not the best, at least equal to any service in the country, with everything connected with it up-to-date and efficient; and when we hear the remarks of our townspeople and of visitors to Leicester, we feel that we have a system of which we may be justly proud. In my opinion there is no finality in tramway enterprise, and I think there are still improvements which might be made. The system which we have now inaugurated is an improvement with many advantages. It is almost universally in vogue in America, though it is not an American invention. Montreal was the first city to adopt the principle, and so quickly were its benefits recognised that within a short time the P-A-Y-E system was installed in the majority of large towns in the Dominion and in the United States. We did not adopt the system because it was in vogue in America. Everything is not good which comes either from America or Canada; and I am not one to decry Britain. I believe we have as much originality and enterprise in Britain as any other country possesses. But the Tramways Committee is always open to receive suggestions from any source, whether local or foreign. We see many suggestions in the papers about tramway improvements; we do not always adopt them, for some are foolish, but we do always consider them. But in the P-A-Y-E system we saw great advantages. We have every year a large number of accidents obtained by people boarding and alighting from tramcars; the number during last year was nearly 500. Under the new method just inaugurated, these mishaps will be almost entirely obviated. Then there are undoubtedly passengers who are not slow in seizing an opportunity of escaping paying their fare. The average Leicester man or woman scorns to do such a thing, but there are cases of this kind to contend with, and under the new system these unscrupulous persons will be obliged to pay. The great inconvenience caused to passengers in a crowded car by the conductor scrambling round to collect fares, and running up and down stairs, will be avoided. The conductor will be always on the platform, and he will be able to notice any signal given by persons desiring to alight, or by persons running to catch the car. Altogether, I think the system will be a great boon to the riding public. In conclusion, let me thank the representatives of the P-A-Y-E Company for their great courtesy and kindness in all their dealings with the committee. They have tried to embody their ideas and ours, and the work has been carried out quite harmoniously. Now that Leicester has taken the initiative, I believe that before long the system will be installed in the majority of the towns in the country.

Mr. L. Charles Huppert, managing director of the International P-A-Y-E Tramcar Company, who also responded to the Mayor's toast, said: I congratulate the Corporation of Leicester on their enterprising step in adopting the P-A-Y-E system on their tramcars. It is now a year and a half since we came to this country and endeavoured to introduce our system. I personally interviewed representatives of many municipalities and placed the method before them; in the majority of towns I was told that the sooner I went home to America the better. I was also told that we should not put into practice our system on double-decked cars in Britain within five years. Those gentlemen have proved to be wrong, for we discovered Leicester on the map and we were successful in installing our system here. The advantages of the system are numerous. The public will appreciate the fact that the conductor is always on the platform, which prevents accidents occurring. From the point of view of the Corporation, it is important that no accidents should take place in connection with the tramway service. The conductor never leaves his post on the platform, and therefore is always in control of the car. I was told that we should not be able to cope with the difficulty afforded by the arrangement of zone tickets. That difficulty has been absolutely swept away, and on the Leicester cars there will be no less than twelve different kinds of tickets in use for the various zones. I am confident that now Leicester has taken the initiative in adopting the P-A-Y-E system, other towns will follow its example, for the eyes of tramway authorities in many great towns in all parts of the country are turned towards Leicester, for they are anxious to know how the system works. I hope that the public of this great town will co-operate with the Tramways Committee in working the new system, and I am sure they will appreciate it. As Alderman Flint has said, we shall always find that certain people will attempt to avoid paying for their ride. That is made impossible by the P-A-Y-E system. The Tramways Committee will therefore secure more profits, for the purpose, if they so desire, of relieving the rates. It is a matter for congratulation that Leicester has been the first town in Europe to adopt the P-A-Y-E system on double-decked cars, and I am perfectly sure that you will have many deputations from other towns visiting Leicester to see how the method works. I think that Leicester is fortunate in having as chairman of the Tramways Committee such an energetic, wide-awake, and clever man as Alderman Flint. He has a perfect knowledge of the tramway service. I do not know whether he is an engineer, if not, he ought to be. The town is well served by a committee of up-to-date, bright, and enterprising gentlemen, and I thank them for the extreme courtesy and kindness which the representatives of the P-A-Y-E Company have received at their hands. I also thank Mr. Lucas and Mr. Smith, the general manager and the electrical engineer, for their courtesy. I do not think that the committee could have more capable officials than these two gentlemen. They certainly know their business thoroughly. With such a body of smart and intelligent men as the drivers and conductors of the Leicester tramcars the system will, I am sure, be a great success. I thank you, Mr. Mayor, for honouring us with your presence, and I am confident that when the system has become familiar, Leicester will want only P-A-Y-E cars.

Alderman Banton, vice-chairman of the committee, hoped that the public of Leicester would note the kind words which Mr. Huppert had spoken of members of the committee. I believe, he said, "that the P-A-Y-E cars will become popular among the people of the town."

Mr. Frank Paul, on behalf of the representatives of the P-A-Y-E Company, expressed their great appreciation of the courtesy shown them by the Tramways Committee and the officials.

Mr. T. R. Smith, electrical engineer of the Corporation, said: "We naturally hesitated to accept the P-A-Y-E system, but after the method had been so competently explained by Mr. Huppert, we recognised its advantages, and I am confident that it will be a great success."

Alderman Tollington also expressed the opinion that the system would meet with the approval of the Leicester public.

The proceedings closed with a toast to "The Mayor of Leicester," proposed by Mr. Huppert in felicitous terms.

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LOOSE CHECKS OR GUARDS ON TRAM RAILS.

By W. R. Millar.

Among the many subjects at present engaging the attention of tramway engineers none are more worthy of close and careful study than those relating to the maintenance of the permanent way, and more especially to those portions of the track which are most liable to call for frequent adjustment and repair. Owing to the restrictions imposed on the permanent way engineer by the narrowness of the streets in most of our large manufacturing towns, the minimum radius of curve is of necessity much lower than good judgment would otherwise consider advisable, and when, as in many instances, there is added to this an objectionable cross-fall in the wrong direction, it is evident that the conditions all tend to reduce the life of the track.

Various styles of rails of varying grades of steel have been tested on curves during recent years, the more modern practice appearing to favour the use of composite rails (made up of a running rail and a guard or check plate) on the inner rail of the curve with a wide-grooved rail of the normal girder section for the outer gauge line.

Looking back over the history of tramways in this country it is readily seen that these composite rails are in reality a reversion to one of the main features of an earlier type of construction. True, it may be said that this return to an older fashion is really only partial, as the loose check plate construction is only adopted by modern engineers to meet purely local conditions on a very small percentage of the total rail-length in the track. As a matter of fact, permanent way engineers have begun to realise that it is very wasteful to have to scrap an otherwise perfectly good rail merely because the check has become worn away to such an extent as to render it unserviceable, and they have therefore set themselves to devise some form of renewable check or guard which can be refitted from time to time without disturbing the running rail, in order that the full life of the latter may be obtained.

The problem presented to the tramway engineer is not easily solved, as there are many extraneous influences which require consideration that do not affect his colleague on the railway; for instance, the ideal tramway check or guard plate must present the minimum amount of metal to the road surface and, at the same time, provide the maximum rigidity to resist side thrust; it must form no impediment to the satisfactory paving of the margin, and yet it must be readily renewable with the minimum of disturbance to the roadway. An extra wide groove or an increase of height of the check above the level of the running rail tread is a matter of small moment on a railway track, but in the paved streets of our large towns any slight increase beyond the normal in either of these two directions is almost certain to call forth strong criticisms in the public press from members of the cycling fraternity, or, what is worse still, actions for compensation or damages in a court of law.

The most familiar type of check rail is that usually adopted by railway engineers, which consists of another rail of similar dimensions placed alongside and parallel to the running rail, the requisite distance between the rail heads being obtained by means of distance blocks of cast iron, either formed in the chairs or independently secured in place by means of bolts. This form of guard, whilst it undoubtedly serves very well on a railway, is by no means so suitable for use in streets subjected to heavy vehicular traffic, owing to the unnecessary width of metal exposed to the surface of the road.

Before the introduction of the grooved girder rail into common use, tramway engineers made several attempts to design some more satisfactory form of loose check plate which would meet the conditions imposed without being unduly expensive. In Dr. Kinnear Clark's book on "Tramways" several of these earlier forms are illustrated, and it is interesting to compare the designs there shown with those which are being put forward by up-to-date engineers at the present time.

Fig. 1 illustrates a combination of running rail and check bar introduced by Mr. Lizar on the Belfast

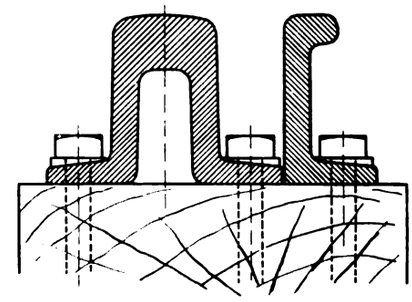

Fig. 1.

Harbour Tramway about the year 1870. The check rail consisted of an angle bar about 4 in. deep, spiked down to the sleepers, and apparently not directly attached to the running rail. It is stated that this check was very easily displaced owing to the insecure method of fastening, and that it was almost impossible to maintain an even groove width. In later track laying at Belfast this type of construction was abandoned in favour of a solid iron rail in one piece,

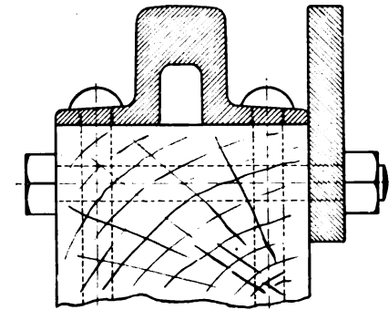

Fig. 2.

but a loose check plate was used on sharp curves, and was arranged in the manner indicated in Fig. 2. That this latter construction proved fairly satisfactory is evident from the fact that although first adopted in 1875 it was still in existence on certain curves a few years ago.

In 1887 the Glasgow Harbour Tramways introduced

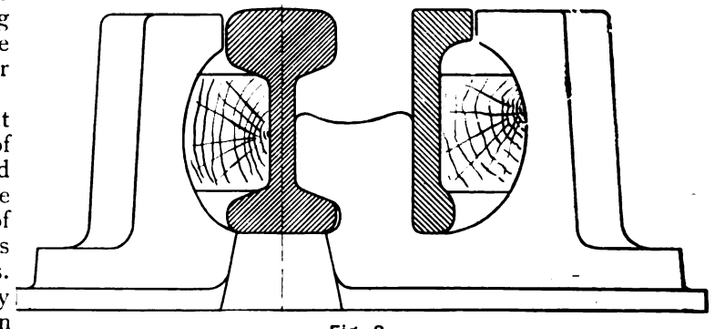

Fig. 3.

the combination illustrated in Fig. 3, which followed very closely on the standard railway practice except

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that the check was formed by a bar instead of a rail, and the chairs were brought level with the granite paving. It will be noticed that in this design the check bar was well supported, as not only was it backed up by the oak keys, but any slight deflection would cause it to bear directly on the upper edges of the chairs.

The simplest form of guard plate in use at the present time is that commonly laid with flat-bottomed rails in many large manufactories for maintaining the groove width in the macadam roadways. It consists of a flat bar laid edgeways so that the base rests on the sleepers and the upper edge comes level with the rail head, the connection between the rail and check being made by means of cast-iron distance pieces and ordinary bolts. In some cases the bar is reduced in depth, and the chocks extended underneath it, as shown in Fig. 4, the advantage claimed for this construction being that it offers a metal bearing underneath the bar to resist the downward thrust of vehicular traffic.

The success or failure of a check bar of this kind, or indeed of any kind, depends very largely on the position and spacing of the attachment bolts; these should be placed as near the upper edge of the bar as possible, so as to resist the bursting action created by the side thrust of the wheels, and the centres should be fairly close so as to prevent the deformation of the bar between attachments. In this connection it should be stated that a guard plate of this description is more frequently distorted by the dirt which lodges in the groove cavity being pressed downwards and outwards by the weight on the wheel flanges than by actual side thrust of the wheels.

Another, but more advanced, form of bar used in conjunction with flat-bottomed rails is that shown in Fig. 5. Here the cast-iron distance pieces are dispensed with, and the bar is rolled to shape and of such a section that when securely bolted to the vertical web of the rail the requisite width of groove is obtained. This design of composite rail is sometimes used for car shed "fans" and other work of a similar character. It is much easier to keep the groove clean, and the bar is not so liable to become distorted as in the two previous types.

In 1903 the Aberdeen Harbour Board adopted a very substantial composite section (Fig. 6) for use on their new tracks. The running rail was of strong flat-bottomed section, 111 lb. per yard, and the check bar was riveted to the vertical web of the rail by a staggered row of $\frac{7}{8}$ in. diameter rivets about 18 in. pitch. Wherever it was desired to widen the groove on sharp curves, a secondary packing bar was introduced between the web of the rail and the check, corresponding in thickness to the increase in width required.

It is evident that this check plate can hardly be considered as readily renewable, and it is an open secret that the original intention was to obtain a grooved girder rail in one piece, but, owing to the impossibility at that time of procuring a section of the weight and calibre required, the engineer was compelled to adopt a composite section to overcome the manufacturing difficulties.

Among the standards put forward by German engineers during the congress held at Hamburg in 1909, the composite section shown in Fig. 7 is of interest. This is a proposed combination of a Haarman rail with a renewable guard plate which fits the rail like a fish plate. The method in which it is proposed to attach the plate to the running rail is not stated, but if a single row of bolts along the centre line is suggested, the plate section would appear to be somewhat weak to resist the tightening of the bolts.

On the Continent composite rails are used to a much greater extent than is common in England, and the type illustrated in Fig. 8 may be taken as fairly representative of the designs adopted. It is not easy to understand the reason for the wide tread on the check rail, as this would certainly be a great objection to the use of similar sections on English tramways. It may be, however, that the metal is so disposed to give vertical and lateral stiffness to the check rail, and its presence on the road surface is not considered detrimental. In most of these composite rails the chocks are spaced at frequent intervals and the bolts are numerous, so that the connection between the various parts is made as rigid as possible, and the result appears to be satisfactory.

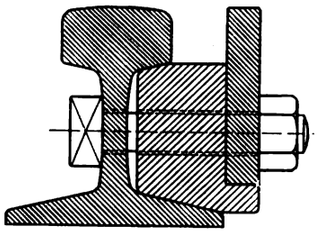

Fig. 4.

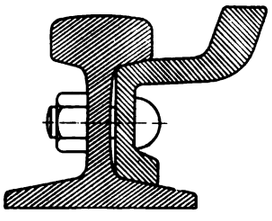

Fig. 5.

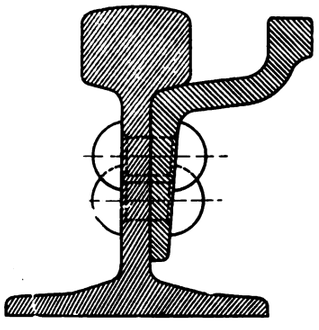

Fig. 6

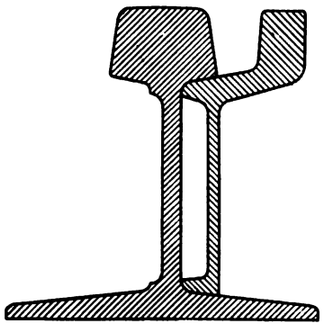

Fig. 7.

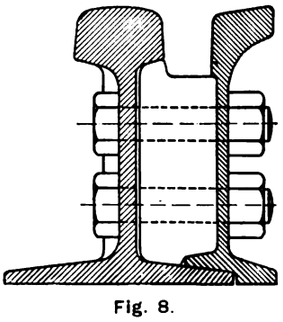

Fig. 8.

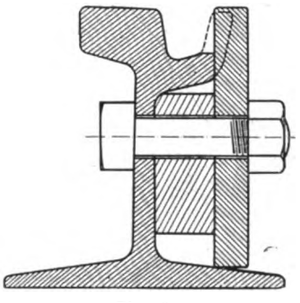

Fig. 9.

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Tramway engineers in this country do not look with favour on the introduction of varying sections of rails on their systems, and have therefore attempted to meet the conditions by modifying and adding to the standard sections in use in such a way as to reduce the special fittings to a minimum.

Fig. 9 shows a very common form of check plate for attaching to the normal girder rail section. The check of the rail is removed, either by chipping or planing, and a loose guard plate is attached to the vertical web by bolts and cast iron distance pieces. The check plate may be made either from ordinary or manganese steel, preferably the latter, and the bolt holes should be arranged so that the plate can be reversed when worn out on the upper edge. This does not of necessity mean that the holes should be exactly in the centre of width of the bar. As a matter of fact, some engineers purposely allow the holes to be spaced about ¼ in. out of centre in order to compensate for the tread wear which takes place during the period of life of the upper edge of the check plate, and by this means are able to bring the top of the bar approximately level with the tread again after reversal.

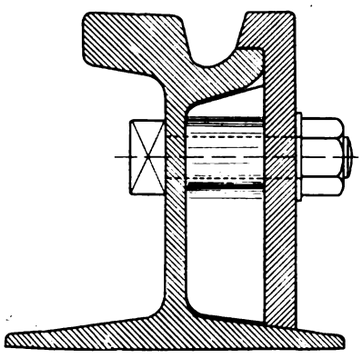

Fig. 10.

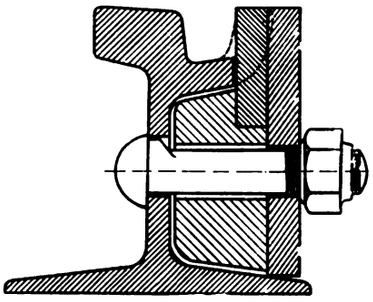

Fig. 11.

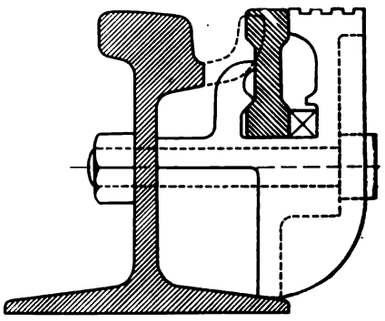

Fig 13.

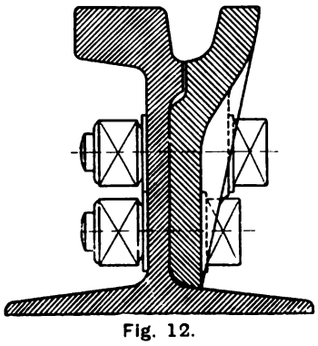

Fig. 12.

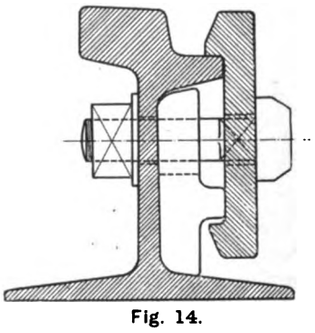

Fig. 14.

The makers of Ames' patent check plate (Fig. 10) claim that it can be added to existing curved rails by removing the major portion of the worn guard or check and drilling the necessary holes for attaching the plate in position. To attempt to perform this operation in the road without removing the rails is a somewhat difficult and expensive matter, although we have heard of it being tried. There can be little doubt that a more satisfactory and durable repair is ensured when care is exercised in fitting the guard plate in position.

Fig. 11 illustrates a design which has been put forward to reduce the amount of metal which is discarded every time the narrow strip of check which reacts on the wheels is worn out. As will be seen from the illustration, this check plate is reduced in depth, and takes the form of a narrow bar resting on a projection on the cast-iron distance block. The bar is not secured by through bolts, but is merely clipped in position by cramp plates, and it is therefore readily lifted out and reversed when the groove width has increased beyond safe limits.

The Bulfin guard plate (Fig. 12) is made from cast manganese steel in lengths of about 3 ft. 6 in., special short lengths being provided to take the place of the fish plates at the joints. This plate is very securely attached to the vertical web of the rail, and forms a very reliable check on difficult curves. Holt's patent guard rail (Fig. 13) is made of rolled manganese steel in lengths of approximately 20 ft.; it is held in chairs which are bolted to the rail at about 2 ft. centres, and the bar is keyed in place to prevent it working loose.

The London County Council use a special reversible check or guard plate (Fig. 14) made from either high silicon or manganese steel. The bar is used in conjunction with a specially-rolled section of rail having a flat tram forming the bottom of the groove, but no check. The attachment bolts have "T" shaped heads, and are spaced about 15 in. apart. This check plate is so designed that it is possible to fit the normal fish plates between the guard and the web of the rail by using special bolts.

The foregoing samples may be taken as fairly representative of the various designs of check or guard plates in use at the present time. The choice of the most economical type to be adopted will very much depend on local conditions: it cannot be claimed that any one of them reaches perfection.

Blowing Over of a Bradford Car.—The Board of Trade have held an inquiry into the circumstances of the blowing over of an electric car at the Allerton terminus of the Bradford tramways, on the night of February 10, during a heavy gale. The Board do not consider that the structure of the double-deck car, fitted with an over-hanging top, was a contributory cause of the accident. The Board have suggested the placing of wind gauges at certain points on the more exposed portions of the route. The wind gauges will serve to give warning to the head office of any rise in the wind pressure which may endanger the stability of the cars, so that instructions may be sent out to the drivers as to precautions to be taken.

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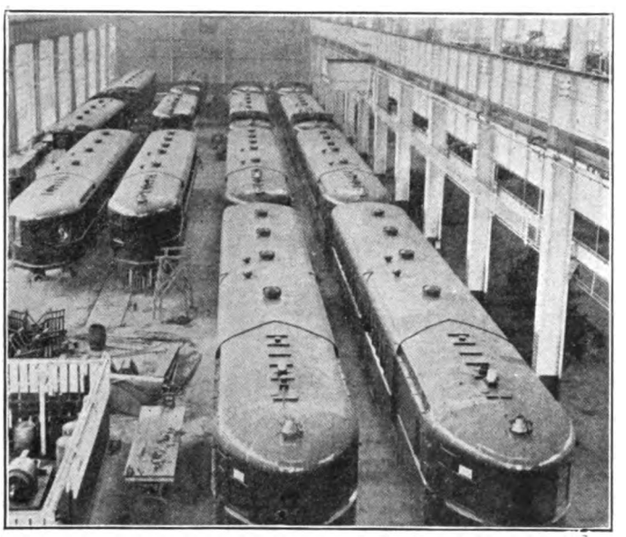
PETROL-ELECTRIC RAILWAY CARS IN AMERICA.

In this country petrol-electric railway cars have been tried only to a very limited extent on railways, though they possess distinct advantages as to control and absence of change-speed gearing as compared with petrol cars with mechanical transmission of power to the wheels. The petrol-electric system is, however, now being used to a considerable extent for road omnibuses in London and elsewhere. It has been much improved within the last year or two, and probably its use will extend both on roads and railways. The advantages of some sort of automobile car for branch lines of small traffic are of course obvious, and are widely recognised.



Petrol-Electric Cars under Construction by the American General Electric Company.

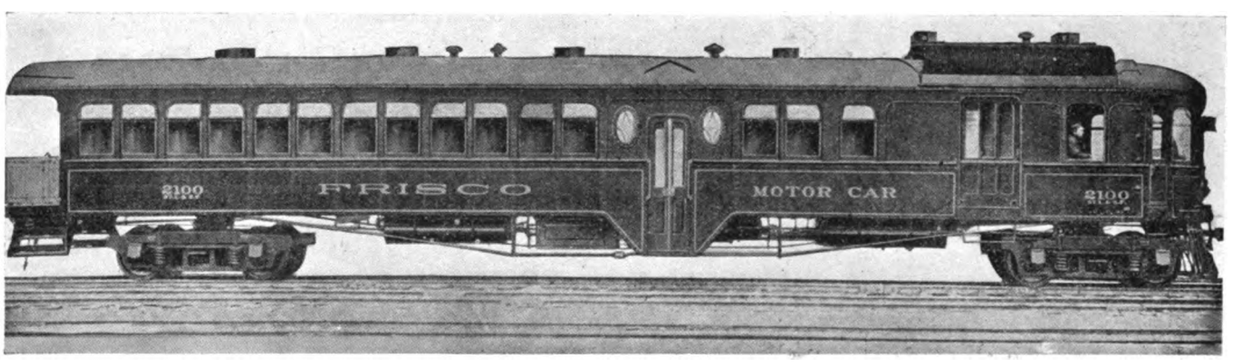
In the United States the petrol-electric car has been more widely adopted for railway work than it has been here, though the fact may have escaped the attention of some readers, because what is called petrol in this country is called gasoline in America, and the cars are referred to as gasoline-electric, and sometimes as gas-electric.

An interesting sketch of the situation as regards these cars in America is given by the *Railway Review*, of Chicago, which says that the introduction of the self-propelled car in the railway field has been watched with interest by railway officials. It offered an opportunity for more efficient operation of supplementary service, branch lines, and connecting divisions. It appeared to be the solution of an annoying problem of minimising or eliminating the unprofitable operation of the short lines extending through territory not densely populated. What is wanted is an approximation to the flexibility of tramway working. As in that service, reliability and low maintenance costs are important factors in branch line service, and railway managers have carefully noted the actual performance of the cars in this respect.

One of the types of self-propelled cars which has come into increasing use and popularity is the gas-electric car. At the end of last year, 22 railroads had self-propelled units of this type operating on regular local schedules. In nearly all these cases the cars were employed for branch line service, replacing steam trains which in many instances were operated at a loss, due to local traffic conditions. A gas-electric car, operated as a train with a trailer, is also now being tried for regular local train service, and will be interpolated in between the schedules of limited through trains on the main line four-track road of the Pittsburg and Lake Erie system.

An analysis of the operation of these cars reveals some very interesting features. While the consumption of petrol necessarily depends on the character of the traffic and road bed, it has been demonstrated in practice that it averages low. This, it is claimed, results from the principle of propulsion employed in the petrol-electric car. Through application of electric transmission to the internal combustion engine motive power, rapid acceleration and flexibility of operation are obtained, by varying the strength of the generator field, without rheostatic power losses or gear changes. A further economy is effected through provision for governing the driving motors by shunt field control. Through this method of control, full utilisation of the power input is secured throughout the entire speed range from start to full speed.

The experience of railroads using these cars has now been sufficiently extensive to establish their salient points of advantage under diversified service conditions. Wherever these cars have been adopted, very marked two-fold benefits have resulted. Not only have the cars proved reliable and economical to operate, but the development of new business has been particularly noticeable. The working costs per passenger have been appreciably reduced, and traffic has been greatly stimulated through the readiness of the public to take advantage of the more frequent and convenient schedules. As showing the extent of the business in America, we reproduce a photograph taken some months ago of work then in progress in the shops of the General Electric Company, at Schenectady, New York. Here were then 14 of the cars under construction for various railways.



Petrol-Electric Car on an American Railway.

One of the most significant tendencies in connection with the introduction of the petrol-electric cars is

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shown by the fact that 40 per cent. of the roads have subsequently ordered additional cars. Amongst the largest users of petrol-electric cars is the St. Louis and San Francisco Railroad, popularly known as the "'Frisco System," which now has 17 of these self-propelled units running regularly on branch lines.

CENTRAL ENTRANCE CARS IN WASHINGTON.

In recent issues we have published descriptions of types of American cars with central entrances and dropped sills, providing for the passenger having only one step up from the street to the car platform. The accompanying illustrations show another type of central entrance cars which has just been put into service in Washington. Thirty city and five suburban cars of this class were embodied in an order to the J. G. Brill Company by the Washington Railway and Electric Company. The type is based on that of the original Washington central entrance car which was designed by Mr. W. A. Wenner, master mechanic of the railway company, and which was placed in service in the capitol city over a year ago.

The principal change in the new cars is in the door arrangement. This in the original car included three door units, those on the outside for exit and that in the centre for entrance. The decrease in the total width of the door opening in the new cars, by the use of an individual entrance and exit, while not increasing the seating capacity has given a larger working space to the motorman, and separates him more effectively

Central Entrance of Washington Car.

from the passengers without resort to bulkheads. In the new cars he is separated from the passengers by a curved railing, which is dropped behind him, level with the seat backs, and can be raised out of the way on pipe stanchions, making the end of the car available for standing passengers when running in the opposite direction. The conductor's position, as heretofore, is in the centre, where there are two door-control stands, each operating the nearer set of two-leaf folding doors and synchronal folding steps, through a simple lever arrangement. The door opening is divided by a pipe stanchion that extends from the platform floor to the top rail over the door. Four additional pipe stanchions, extending from the platform floor to the head lining, are placed where the aisles meet the platforms, and in

Interior of Car with Central Entrance.

addition to reinforcing the roof they give a support for standing passengers.

The seating arrangement is shown in the plan reproduced. Because of the larger space allotted to the motorman and the use of a smaller platform, the scheme includes four reversible seats and one stationary cross-seat placed on each side of both halves of the body. Near the ends of the car a longitudinal seat is placed on each side. Four folding seats, each for one passenger, are hinged to the platform panels, and may be folded up when the adjacent door opening is in use. The total seating accommodation is for 50.

The windows are of the semi-convertible type, in which the two sashes have a weather-proof hinged joint, and both disappear into roof pockets. Mahogany, inlaid with narrow lines of white holly, is the only wood used inside the car.

The suburban cars differ from the city cars principally in being 5 ft. longer and in having a somewhat different seating arrangement, the accommodation being for 55 passengers.

The body framing of both types consists of $2\frac{1}{4}$-in. ash side posts, and $3\frac{3}{4}$-in. corner and $3\frac{1}{2}$-in. centre door posts. These are secured to a $2\frac{1}{8}$-in. by $2\frac{3}{4}$-in. yellow pine top rail. Below the level of the belt rail (just under the windows) chestnut sheathed with steel is used in the city cars, while the suburban cars have ash ribs between the posts, which are covered with poplar board sheathing. Contrary to usual practice, the side sills consist of two distinct lengths of $3\frac{7}{8}$-in. by $7\frac{3}{4}$-in. yellow pine, extending from the centre door posts to the vestibule posts in the city car and the body corner posts in the suburban. They are reinforced with $\frac{3}{8}$-in. by 15-in. steel plates, which are dropped at the centre platform. From a point about 3 ft. beyond each centre door post, a 6-in. channel and a $\frac{3}{8}$-in. by 10-in. steel plate reinforce the sill plate, thereby stiffening the sides of the centre entrance. Two 3-in. I-beam centre stringers run through from end to end, depressed under the centre platform; they are securely bolted to $1\frac{3}{4}$-in. by 3-in. and $4\frac{1}{2}$-in. by $4\frac{1}{2}$-in. oak crossings affixed to the steel sill plates with 3-in. by 3-in. by $\frac{3}{8}$-in. angles. The body bolsters of the city cars are cast steel, and those of the suburbans of the plate type, the bottom

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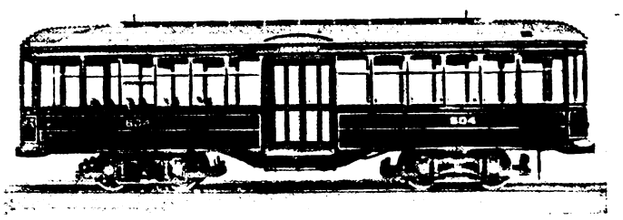
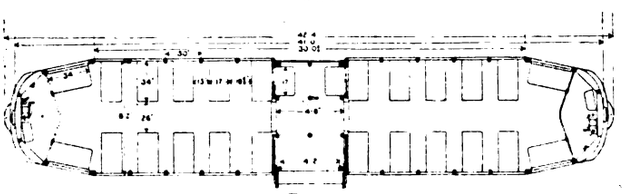
members being riveted to the I-beam centre stringers. The five suburban cars are mounted on Brill No. 27-M.C.B1 trucks, with solid forged side frames, and are capable of a speed of 50 miles per hour.

The following particulars apply to the city cars:

Length over buffers	41 ft. 8 in.
Length of centre platform	4 ft. 8 in.
Centres of side posts	2 ft. 6 in.
Width over sills	8 ft. 2 in.
Width over posts	8 ft. 2¾ in.
Extreme width	8 ft. 2¾ in.
From track to side sills	2 ft. 2¾ in.
From rail over trolley boards	11 ft. 6 in.
From track to step	13½ in.
Step to platform	12 in.
Platform to floor	10 in.
Seating capacity	50
Type of motors	West. 306—4-50 H.P.
Weight of body less electrical equipment	16,585 lb.
Weight of electrical equipment	1,500 lb.
Weight of air-brake equipment	1,500 lb.
Weight of motors	11,500 lb.



EXTERIOR.



PLAN.

Centre Entrance Car for City Service.

The following particulars apply to the suburban cars:

Length over buffers	46 ft. 0 in.
Length of centre platform	4 ft. 9½ in.
Centres of side posts	2 ft 7½ in.
Width over posts	8 ft. 6¾ in.
Extreme width	8 ft. 6¾ in.
From track to side sills	2 ft. 5⅜ in.
From rail over trolley boards	11 ft. 10½ in
From track to step	14¾ in
From step to platform	13 in.
From platform to floor	10 in.
Seating capacity	57
Type of trucks	Brill No. 27-M.C.B1
Wheel base	6 ft. 0 in.
Diameter of wheels	32 in.
Size of journals	3¾ in. by 7 in.
Type of motors	West. 306—4-50 H.P.
Weight of car body less electrical equipment	17,000 lb.
Weight of electrical equipment	1,500 lb.
Weight of air-brake equipment	1,500 lb.
Weight of trucks	13,400 lb.
Weight of motors	11,500 lb.

TRAIL CARS IN LONDON.

The London County Council has now begun to use the Parliamentary powers obtained in the last session to run trail cars. A number of disused horse cars have been adapted for use as trailers and are now in service on the route between Eltham and Woolwich, largely used by the Arsenal workmen, the vehicles being attached to double-deck bogie cars. In accordance with arrangements made with the Board of Trade the experiment at the start is to be restricted to the hours of 6 a.m. to 10 a.m., and from 4-30 p.m. to 11-30 p.m. One car was in service on March 22, and additions have been made since. The Wellhall Road section of the route provides a steep gradient leading to Shooter's Hill. So far none of the alarming consequences prognosticated by the police department, who strongly opposed the innovation, have occurred.

CORRESPONDENCE.

TRAMWAYS IN INDIA.

TO THE EDITOR OF THE TRAMWAY AND RAILWAY WORLD.

SIR,—That the railways of India, 33,000 odd miles, are too few to serve adequately either its area or its population, is very generally admitted, but it is seldom that any such reference is made to its tramways, and yet the cities of India served by tramways can easily be counted on the fingers of both hands. The reason why there are so few tramways is not far to seek. It is that until very lately, with few, if any, exceptions, the tramways of India were not financially successful, and what had been done was not encouraging for others to "go and do likewise." The Indian generally is a low-paid man, and it is imperatively necessary to carry him cheaply if you are to persuade him to ride. This means, compared with the west, low receipts per car-mile, and if you have low receipts per car-mile you must have correspondingly low running cost per car-mile, otherwise the profits are wiped out.

To make Indian tramways successful, first cost must be kept down to the lowest possible limit, and the total cost of working must also be low, but with electric traction neither of these essentials can be obtained. Whatever may be said in favour of electric traction for tramways, it cannot be claimed that it is cheap to install, nor is it cheap to work. It has many advantages, but it certainly has not these two essentials to its success in India, although until very recently it seemed to be the only practical system available.

Fortunately for India, petrol traction was some three years ago introduced at Karachi, and its great success in that town seems to point to its being the system *par excellence* for India. The first cost of a tramway run on this system is low. The cars—46-passenger—are light, and consequently a lighter and less costly permanent way can be used than is required for electric traction. They are self-contained, and no costly generating station, copper mains, standards, etc., are necessary. In consequence the cost of upkeep is low.

The "Simplex" petrol cars, as proved by three years' work at Karachi, are thoroughly reliable, and can be, and actually are worked at the astonishingly low rate of 1½d. per car-mile, including cost of power, maintenance, and repairs. No other system can compare with this, and it seems likely that the "Simplex" petrol car will hold the record in this particular for many years to come. In Karachi the total running expenses, including wages of drivers and conductors and depreciation, was 3·33d. per car-mile, and the total working expenses, including permanent way repairs, rents, rates, and royalties, Karachi and home office expenses, was 4·25d. per car-mile. These cars run easily and silently, the maximum speed is quickly attained, and the cars are under complete control. They can be, and are, driven by native drivers, who quickly learn to manipulate them, the controlling mechanism being very simple.

With such a perfect system available, the extension of tramways in India should neither be difficult nor unprofitable. There are many Indian towns where a reliable tramway system would pay well, provided the capital cost and cost of working could be kept low. The "Simplex" petrol tram makes both these conditions not only possible, but easy to attain, and in the interests of India we hope to see the use of this system very generally extended.

I have no personal interest in the system, but, on general grounds, and in the interest of India, I should like to see it extended.

Yours faithfully,

J. FORREST BRUNTON.

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The Cost of Light Railways.

Objection has often been taken to the excessive sums spent in this country on the construction and equipment of light railways. The critics point to the railways in the United States *sans* fences, *sans* ballast, *sans* drainage. These have been running for years, and have greatly assisted the agricultural development of new lands, by enabling the produce to find a market on reasonable terms. They may be said to have fulfilled admirably and at a small prime cost the objects their promoters had in view. We, on the other hand, have gone to the opposite extreme, and our so-called "light" railways differ but in a small degree from our fully-equipped and magnificent main lines, of which we are all so proud. In the case of railways intended to help agriculture, or to take the place, in a great measure, of transport by road, such magnificence, or anything approaching to it, is not business. We have pointed out the possibilities of using tramways for the transport of goods, but light railways on their own right of way come under a different category and, under existing circumstances, should be constructed, whether for steam, electric, or petrol power, at very little expense, always presuming that the landowners would be reasonable in granting wayleaves. Light railways should be constructed to the normal gauge, and be capable of taking main line rolling stock at a moderate speed. The engines should be special, and their axle loads should not be greater than those of the wagons. In the Leek and Manifold Railway we have an excellent example of what can be done in this direction, as the 30 lb. rails, after many years' service on that line, show no signs of wear. The special gauge of that line is a concession to those who insist that light railways can only be built with a gauge smaller than the normal. This is a fallacy hard to kill —you might as well build a two-wheeled sulky to a 2 ft. gauge—and arises from sheer ignorance or carelessness. In *medio tutissimus ibis* and a mean between the American pioneer corduroy roads and our first-class lines, is what should be attempted. The real difficulty is in the designing of such a line, in the overcoming of old-fashioned objections, and in maintaining it properly after it has been opened for traffic. The highest engineering talent is required to make the best and most economical use of existing conditions. The laying out of a light line that shall involve the least expense on earthwork and on works of art; that should not interfere with the drainage of the lands it goes over, while being properly drained itself; that should avoid level crossings, and interference with the amenities of the country-side—all this calls for the highest skill. The difficulties to be overcome are the rooted objections to fenceless lines of railway; to low platforms; to "dirt" ballast. We are all getting so used to fast traffic on roads and on fixed tracks, that the avoidance of any danger from such lines is fast becoming an inherited instinct. This, in course of considerable time, will perhaps be acquired in the case of erratic motor traffic—but this by the way. Anyhow, a low hedge and small ditch, marking the boundaries of the right of way, should be amply sufficient to keep off intruders. As to low platforms, what is good enough for by far the majority of travellers by rail in the world, should be good enough for those who would use these light lines. A system of line-clears between halts, or of telephone control, should do away with the necessity for any

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signals whatever, and as to ballast, none would be required, always providing the drainage were provided for adequately. Here again the American practice is an object lesson of what can be done without ballast, by slightly increasing the number of sleepers. This leads to the last point, the necessity for careful, unceasing, and vigilant maintenance. It is for want of this that the American pioneer lines are all going to pieces, and without this any light line would soon become almost useless, and most certainly dangerous. The conditions, therefore, for successfully constructing and working light railways are that they should be designed by first-class engineers; that the equipment should be subject to reasonable conditions; and that no money should be spared in maintaining the way and works.

The Cost of Living and Higher Wages.

Though the owners of tramway undertakings seem in the past partially to have escaped from the general demand for higher wages based on the increased cost of living, it appears that that time is over. Requests by tramway employees for increased wages, and strikes because the increases were not granted, have proceeded on various grounds, but within the last month or two demands for improved conditions have been put forward simply on the ground that the purchasing power of money has materially diminished. Employers of labour in many departments of industry have had to face requests of this kind, and whatever the financial condition of the undertaking concerned it has been difficult to resist the action of the employees. This is because the fact on which the demands are based is indisputable. On every hand people both with large and small incomes find that their routine expenditure for the necessaries of life is steadily rising, and no one can say how far this increase may go. The cause generally put forward is, of course, the great boom in trade, and no doubt this is a leading reason. Active trade always means higher prices. On the present occasion, however, the increasing population of the countries from which we obtain so much of our food supplies is undoubtedly a factor, and the shortage of exports from those countries is bound not only to be permanent but increasing. People who are engaged in trade on their own account, and who are sharing in the prosperity of the time, are not, of course, much troubled by the increase in the cost of living. It is the much larger class of people who have only fixed incomes in the shape of salaries or wages who are the sufferers. In the case of artisans and other workmen whose wages never allow of a very large margin, and who have dependants, the present condition of things is peculiarly hard. It is not surprising, therefore, to find tramway employees joining in the call for higher wages. The unfortunate thing for tramway undertakings is that they do not carry on manufacturing or other industries which are making great profits owing to trade activity. They are not even in the position of railway companies, which share in the national prosperity through having to carry greatly increased quantities of goods and minerals. All that the tramway can depend on is getting more passengers, and that only comes about if the mass of the people have more money to spend. So far as can be judged the mass of the people are not exceptionally well off in that regard, owing to the increased cost of the necessaries of life. To some extent, as shown by the weekly traffic returns, the tramway is benefiting, but this is likely to be counterbalanced by the increased wages. The position threatens to become somewhat serious for small tramway undertakings which have only a limited margin or none at all. Moreover, while all this boom is in progress, tramway undertakings have to pay more for all their stores and materials. From one point of view the position may become even more awkward when the next period of trade depression comes. In general industry wages will come down along with the fall in the price of food, and unemployment will increase. The tramways will no doubt suffer a diminution of passengers, though the cost of stores, etc., may become lower. The difficulty will be, for municipal tramways especially, to reduce wages to what should be the proper scale in the circumstances. Therein lies a danger. On the whole the labour outlook does not appear to be specially bright for tramways in the future of a few years hence. Meanwhile one must trust to mutual adjustment of circumstances as they arise.

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Motor Omnibus Problem.

The inquiry by a Select Committee of the House of Commons regarding the causes of the numerous accidents caused by motor omnibuses in London does not appear as yet to be approaching a conclusion. Many details are being investigated, but one point at least is tolerably clear from the evidence already heard. That is that the present system of paying motor omnibus drivers by the journey instead of by the hour or the day must be abolished. There can be no doubt that payment by the journey is a direct incentive to undue speeds after time has been lost by traffic blocks, and to drivers taking risks in crowded streets which otherwise they would not think of doing. These evils are inherent in the system; no amount of instructions can obviate them. Therefore the system must go. From the point of view of the safety of the public, there is every reason why it should go, while there is no sufficient reason why any omnibus company should retain it. Apparently the only argument in favour of the system which is worth looking at is that if the drivers were paid by time, they would make no effort to maintain a reasonable average speed, that much more time would be lost when the traffic is temporarily stopped at busy places by the police, and that in consequence each omnibus would make materially less mileage and less revenue per day. Even if all this should be true, it is no argument for a system which does so much to endanger the public. But it need not prove true. There are such things as schedules of time for running, bonuses for good time-keeping, and penalties for furious driving and accidents. No tramway pays its drivers by the journey, yet tramcars are more delayed by traffic blocks than are omnibuses. If the motor omnibus is such a vehicle that it cannot be made to pay unless the drivers are under constant incentive to recklessness, then it is a vehicle which needs to be consigned to the limbo of the past. Moreover, if no profit can be made out of it by working the men for reasonable hours, as in the case of tramways, that is another argument for superceding the omnibus. The fact of the matter, however, is that the omnibus can stand financially both a proper system of paying men and of granting them reasonable hours. Dividends might be a little lower, but that is of little consequence if the present number of injuries to pedestrians caused by omnibuses is minimised.

Motor Buses and Road Maintenance.

The question of the owners of motor omnibuses being called on to contribute to the maintenance of the roads on which the vehicles run again came before a Parliamentary Select Committee at the end of March and the beginning of this month. In the past, Parliament has refused to make it obligatory on the owners either of trackless trolley systems or of motor omnibuses to contribute to ordinary road maintenance, though in one or two cases of the trackless trolley system agreements for contributions have been made between the parties. In another case power has been given to the road authority to sue in the courts for compensation for extraordinary wear of the roads by trolley omnibuses where such wear can be proved. In the case of Coventry, the Corporation, by their bill, sought authority to run motor omnibuses inside the city, and to a small extent outside of it. The Warwickshire County Council appeared before the House of Commons' Committee on the bill, and asked for the insertion of a provision that the Corporation should pay a contribution towards the extra cost of maintenance of the county roads on which the omnibuses would run. The balance of argument, especially in such a case as the present, is certainly in favour of no contribution unless extraordinary wear is proved. In that case a legal remedy already exists. But a regular annual contribution, whether the wear of the roads by the omnibuses be great or small, would be directly contrary to the spirit of existing legislation, whereby toll-bars were abolished years ago. The contribution would really be a form of toll on a particular form of traffic, while other traffic would go free. Further, in this case, if the Corporation do not run the omnibuses into the county, a company may do so. The company would not need to apply for Parliamentary powers, and there would be no obligation on it to pay for road maintenance. The Committee suggested that the parties should come to some agreement, but they failed to do so, and the Corporation withdrew the part of their proposals for running the omnibuses outside the city. So far, therefore, the legislative position remains the same—namely, that no motor omnibus undertaking is compelled to pay for road maintenance.

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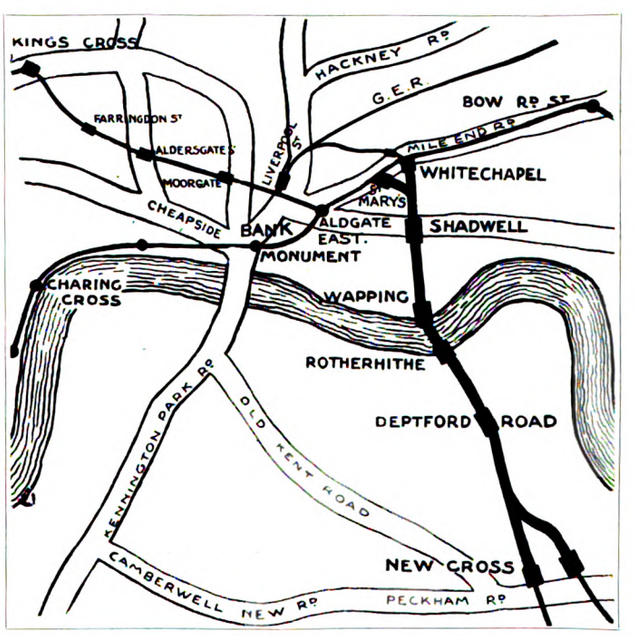
EAST LONDON RAILWAY ELECTRICAL EQUIPMENT.

On March 31 electric trains began running on the East London Railway, and there was thus brought to completion a scheme which has been talked about for many years. The change had been much delayed owing to the difficulty of securing an agreement between the various companies concerned. The East London Railway, looked at historically, forms a big link between the past and present. The past referred to is the time when there were no railways. In the year 1825 the work of construction was begun on what was for many years called the Thames Tunnel, as there was no other subway under the river. Brunel was the engineer, and he encountered great difficulties owing to water getting into the workings, so that the tunnel was not completed until 1842. It was formally opened in the following year, and it was solely used by foot passengers, access being gained to it by spiral stairways at each end. It continued in use for pedestrians until 1869, when a part of the East London Railway was opened, which made use of it.

Metropolitan Railway Electric Train Serving the East London Railway.
(The carriages are of the latest type with doors both at the centre and ends.)

The object of completing the East London Railway was to provide a connecting link between the railways in the eastern half of London north and south of the Thames. At the south end, the line connects by junctions with the London, Brighton, and South Coast and the South Eastern and Chatham Railways at New Cross, and passing through Deptford, Rotherhithe, Wapping, Shadwell, and Whitechapel, it terminates at Shoreditch by a junction with the Great Eastern Railway, through which trains can be run into Liverpool Street terminus. At Whitechapel there is a short junction which connects the line with the Metropolitan and Metropolitan District Railways. The part of the railway from New Cross to Wapping was opened on December 6, 1869, and the part from Wapping to Shoreditch on April 11, 1876. The total length is $5\frac{3}{4}$ miles, of which $1\frac{3}{4}$ miles is in tunnel.



Plan of East London Railway.
Showing connections with the Metropolitan, the Metropolitan District, and the Great Eastern Railways.

Down to the year 1905, when the Metropolitan and Metropolitan District Railways were electrified, through trains were run between these lines and the East London Railway, and it was at that time indicated that the electrification of the latter should be speedily carried out. In the meantime through trains had, of course, to be abandoned, and since then until the present time passengers have had to change. Through running of all electric service is now resumed.

The East London Railway is leased to the following companies: Great Eastern, London, Brighton, and South Coast, South Eastern, London, Chatham, and Dover, Metropolitan, and Metropolitan District. Since the through trains from the Inner Circle ceased running, the traffic on the East London line had gradually diminished, and the situation was so grave that it became imperative to electrify the line. The necessary capital has been provided by the Great Eastern Company to the amount of £90,000. The works were carried out under the supervision of the engineers of the South Eastern, Metropolitan, and District Railways, the first undertaking the general renovation, the second, automatic signalling and electrical equipment of the tracks, and the third, lighting, pumping, and provision of power.

The situation of the railway and its connections with other lines may be gathered from the accompanying map. The permanent way is of the standard South Eastern main line type, and the conductor rails follow the pattern and arrangement of those employed on the Metropolitan Railway. An electrical sub-station having been provided at Surrey Docks, this, along with the Whitechapel sub-station of the District Railway, feeds the conductor rails with continuous current at 600

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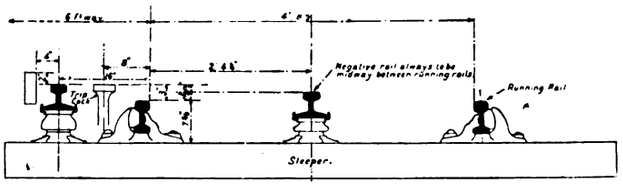
volts. The sub-stations are supplied with high-tension three-phase alternating current from the Chelsea power-station of the District and London Electric Railways. Two high-tension cables for the purpose are laid from Whitechapel to the Surrey Docks. The new sub-station at the latter point contains three Westinghouse rotary converters, each of 300 KW. capacity, and nine air-cooled transformers. The latter change the incoming current from 11,000 volts to 365 volts, and the converters convert it from 365 volts alternating-current to 600 volts direct-current.



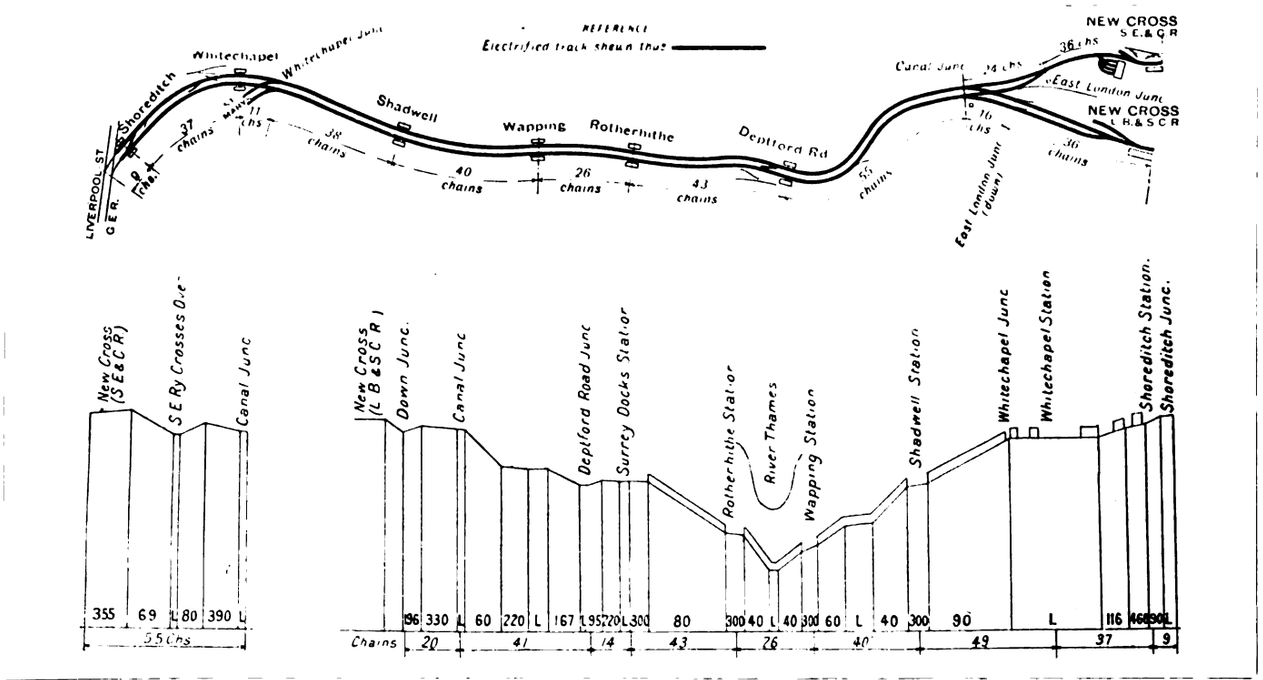
Arrangement of Track and Conductor Rails.

Electric power has been substituted for steam in two power-stations on the line, one of which is at the Surrey Docks and the other at Rotherhithe. At the latter place the original Brunel pump has been in service up to now.

A feature of the automatic signalling is that the track circuits are operated by alternating instead of continuous current, thus preventing any possibility of the system being affected by extraneous currents. The lamp signals employed in the tunnel are provided with red and green Fresnel lenses, behind which two incandescent lamps are placed. These lamps glow alternately in accordance with the desired control. The voltage of the lamps giving the danger signal is considerably lower than that of the lamps for the clear signal, so that it is not possible through any leakage of current for any confusion to arise. The train stops, which are familiar in the Inner Circle, are used in connection with each stop signal. The semaphore signals used on the parts of the railway in the open, are of the usual lower quadrant type. The spectacles are equipped with two red glasses and one green one. Both train stops are semaphore and worked by small alternating-current motors.

The mechanical type of lever frame has been retained at interlockings; the points are worked by rod in the usual way. Illuminated diagrams are provided in the signal boxes similar to those in use on the Inner Circle. Under the new arrangements several of the old signal boxes have been dispensed with.

The new train service consists of 12 passenger trains per hour in each direction, running alternately to and from the New Cross stations of the Brighton and South Eastern Companies, giving a five minutes' service over the railway in each direction. Four of the trains run through from and to South Kensington, *via* Baker Street, while the other eight run to and from Shoreditch. While the Metropolitan Railway Company will work all this traffic, there will be occasional through trains, which will be drawn by the respective companies' steam locomotives as required. The goods train service will continue to be worked by the Great Eastern locomotives. There can be no doubt that the change in motive power will lead to a great increase in passenger traffic. There is, however, little chance of through trains being run on to the Brighton Railway beyond New Cross, as the Brighton Company use single-phase traction with overhead wires, and are thus isolated from other electric railways in the Metropolitan area, unless special rolling stock be provided adaptable to either system.



Plan and Diagram of Gradients—East London Railway.

NEGLIGENT OBSTRUCTION OF TRAMWAYS.

The case of Blain v. Archer came before Mr. Dickenson at the Thames Police Court on March 13. The complainant, Mr. H. E. Blain, general manager of the West Ham Tramways, summoned the defendant, a motor omnibus driver in the employ of the London General Omnibus Company, for negligently driving his vehicle in contravention of the Highways Act, 1835, sections 7 and 8. Mr. Lynch appeared for the complainant, and Mr. Tyndale Moore for the defendant. The magistrate imposed a fine of 7s., and 3 guineas costs, holding that the defendant did by "negligence or misbehaviour prevent and interrupt the free passage" of another carriage—to wit, the property of the West Ham Corporation, contrary to the provisions of the Highways Act, 1835.

This decision is likely to prove of considerable advantage to tramway owners and passengers. Under the Tramways Act, 1870, conviction can be secured for obstruction only if it can be proved to be wilful. Under the Highways Act, it is sufficient to show that the obstruction has been caused by carelessness or indifference.

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ELSENHAM & THAXTED LIGHT RAILWAY.

The Elsenham and Thaxted Light Railway, 5 miles 66 chains in length, and of standard gauge, was opened for traffic on March 31. Sir Walter Gilbey, who had taken a foremost part at the cutting of the first sod in the summer of 1911, purchased the first ticket and, at the call of Sir Ailwyn Fellowes, deputy-chairman of the Great Eastern Railway, declared the line open. The new railway will serve a district greatly in need of the new facilities, the line starting at Elsenham, on the London and Cambridge main line of the Great Eastern Railway, and ending at Thaxted, in Essex. A station has also been erected at Sibleys, to serve the villages of Clinkney and Braxted, and halts have been constructed at Henham and Cutler's Green. Three of the stations and two of the halts are shown in our photographs. Only one bridge had to be erected.

Light Railway Train at Elsenham Station.
(Junction with Great Eastern Railway.)

Sibleys Station.

The total cost has been about £33,000, the Great Eastern Railway Company finding half of that sum, the Treasury giving the remainder. Land was given by the owners and by the promoters of the scheme. Five coaches have been provided, and five trains will be run daily on the down and four on the up journey.

In addition to the gentlemen already mentioned the attendance at the opening included Mr. H. W. Gilbey, Mr. W. H. Hyde (general manager), Mr. F. G. Randall (superintendent of the line), Mr. W. C. May (goods manager), Mr. H. Jones (engineer), Mr. A. J. Hill (locomotive superintendent), Mr. P. Lomas (secretary), and Mr. G. J. Hyde, chief clerk to the general manager.

Thaxted Station.

Henham Halt.

Sir Ailwyn Fellowes, after expressing regret at the absence of Lord Claud Hamilton, the chairman of the Great Eastern Railway, proposed a vote of thanks to Sir Walter Gilbey, to whose good offices, and to the generosity of the landowners in the district, it was mainly due that that line had been constructed. When they knew that Sir Walter Gilbey had motored all the way from Brighton to take part in that function, he was sure they would be grateful to him. The landowners had done a very patriotic thing in giving the necessary land, and he hoped the railway would be of great use to them and their tenants. The directors appreciated very much the work of the engineers' departments at Liverpool Street and Cambridge, and that of the contractors, and of Mr. Martins, who did the earth work. He believed these light railways were of enormous benefit to the districts through which they ran, for they encouraged the development of agriculture and of residential property. He was also confident that this line would act as a very healthy feeder to the Great Eastern, and he believed also it would encourage better farming, and that it would lead to the starting of new industries. Sugar beet and tobacco were now being grown in East Anglia, and he hoped factories would spring up in Essex. He could assure the farmers that if they would co-operate and send their produce in bulk to the railway they would have no reason to complain of the rates charged for carriage. The Great Eastern, like other railway companies, were generally abused, but it must be remembered that the directors had to think of the shareholders. The company were proud to be the premier agricultural line in England, and would always do all they could to meet the wishes and the wants of the farmers in the districts they served.

Replying on behalf of his aged father, Mr. H. W. Gilbey said his father felt that this was the dawn of a new era for that part of the country, for the opening of the railway was bound to benefit the agricultural and commercial community of the district. It seemed to him that railway companies were very often subjected to unfair criticism and unjust abuse; they were the target of almost everybody. Whenever money was required there were three sources that were tapped—railways, the landed interest, and the trade with which he was connected. Whatever criticism might be passed upon railways as at present conducted, he hoped he would never see the day when they were nationalised. (Hear, hear.) He had travelled on the Great Eastern line for 40 years, and he never wished to travel on a better line. For punctuality, for courtesy, for safety, and for the attention they paid to their staff there was no railway in the British Isles that could compare with it. (Hear, hear.) Then they must not forget that the Great Eastern kept their full service running throughout the coal strike, thanks to the foresight of the directors and the loyalty of their

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staff. He hoped the new line would benefit not only agriculturists, but the community generally, and that the railway company also would receive some gain and so be induced to still further extend the line.

The old town of Thaxted, which has a population of 1,700, is 40 miles from London, and there is reason to believe that the railway facilities now afforded will bring it into favour as a residential locality. This is

Cutler's Green Halt.

the second light railway built by the Great Eastern in Essex. The first runs from Tollesbury to Kelvedon, where it joins the Colchester line. According to Mr. Hyde, the general manager, this line has been attended with the greatest possible success, the agriculturists round about Tollesbury and Tiptree having benefited considerably by the facilities afforded for the disposal of their produce.

LONDON MOTOR TRAFFIC INQUIRY.

Evidence by motor omnibus and tramcar drivers was given at the resumed sittings, on March 18, 25, and 27, of the House of Commons Committee, which is inquiring into accidents with power-driven traffic in London. The majority of the 'bus drivers complained of their wages and hours of work. On Tuesday, April 1, the first witness was Sir John H. A. MacDonald, president of the Scottish Automobile Club, who corroborated a good deal of the previous evidence as to the cause of accidents in London, in so far as the opinion is held that the method of crossing the road usually adopted by the public tends to accidents. As to drivers of mechanically-propelled vehicles, he would make it a question of imprisonment after a second summons for driving to the danger of the public.

Further Evidence on Tramway Accidents and Brakes.

Mr. A. L. C. Fell, chief officer of the London County Council Tramways, continued his evidence, which was interrupted before the Parliamentary recess, and first supplemented his previous evidence on a number of points, which he had been requested to do by several members of the Committee. The total number of electric car-miles run each day of the week during 12 months from January 1 to December 31, 1912, was as follows: Sundays, 5,100,942 miles; Mondays, 7,715,000 miles; Tuesdays, 7,689,457 miles; Wednesdays, 7,461,526 miles; Thursdays, 7,452,107 miles; Fridays, 7,513,806 miles; Saturdays, 8,029,535 miles. The point had been raised that the number of fatal accidents on Sundays was higher than on week-days, due to the cars being run at a higher speed, but a careful analysis of his records has shown that this is not the case. For instance, out of the 21 fatal accidents on Sundays during the five years and nine months to December 31, 1912, 11 occurred when the speed of the car was under eight miles per hour, three when the speed was given as moderate, five when it was from 8 to 10 miles per hour, and two when it was from 10 to 12 miles per hour. Further, five of these fatal accidents occurred through persons endeavouring to avoid motor omnibuses, or through their view of the road being obstructed by motor omnibuses. As to the suggestion that motormen travel home late at night at excessive speeds, any man bringing his car into the shed before the proper time was severely reprimanded.

The width of roads in their relation to danger was also gone into again and Mr. Fell's previous evidence amplified. The most dangerous width, according to statistics, is that where there is just room for two vehicles to pass between a tramcar and the kerb. With a width of 32 ft. there is just room for one line of traffic between the car and the kerb, and under these circumstances there is comparative safety. With 40 ft., however, there is just room for two lines of traffic between the car and the kerb, and the danger has occurred at stopping places where a second vehicle has attempted to pass between the tramcar and another vehicle, thus bringing about what Mr. Fell described as a "pinching" effect at the tramway stopping places. To avoid this he recommended the fixing of a refuge between the tramcar and the kerb, thus reducing the width to that of only one line of traffic. With a 54 ft. width there was room for two lines of traffic between the kerb and the car with safety, but at 60 ft. a similar condition of affairs prevails as at 40 ft., inasmuch as there is just room for three lines of traffic, and at tramway stopping places the third vehicle trying to pass created a similar danger as the second vehicle in the 40 ft. road. With a width of 70 ft. there would be room for two lines of traffic next the kerb, then a refuge, and then the tramway. In making these calculations, Mr. Fell allowed 7 ft. 6 in. for each line of traffic.

On the question of accidents caused by defective tramway track, it was stated that during the 12 months to December 31, 1912, there was one fatal accident through two vehicles colliding owing to alleged defective track, *i.e.*, where the guard rail projects above the surface of the roadway through the other portion of the rail having been worn away. There had also been in this period 44 non-fatal accidents through vehicles breaking down on the track, 12 by cyclists skidding, seven through pedestrians falling on the track, three through vans skidding on the track, and two through vehicles colliding owing to the alleged defective track. As a matter of fact, although the Council paid compensation in a number of cases, the accidents through vehicles breaking down were frequently caused through defective wheels on the vehicles themselves. The total compensation paid in 1912 was £776, an average of slightly over £11 per accident.

As to the efficiency of tramway brakes, figures were given of tests recently carried out with the special track brakes used on Highgate Hill, of which the particulars are as follow: At a speed of 3·7 miles per hour, the stopping distance was 9·25 ft.; at 5·52 miles per hour, it was 10·5 ft.; at 9·8 miles per hour, 30·5 ft.; at 11·45 miles per hour, 34·5 ft.; at 13·98 miles per hour, 38·5 ft.; at 15·98 miles per hour, 55·5 ft.; at 18·46 miles per hour, 58 ft.; at 20·33 miles per hour, 63 ft.; and at 23·1 miles per hour, it was 80·5 ft. Thus, under a speed of 20 miles per hour the car was stopped in less than two lengths by the application of the grip brake alone.

Tramcar Speeds and Motormen's Hours.

Another point upon which the Committee desired a certain amount of amplification of Mr. Fell's previous evidence was as to the length of service of motormen, and the variation in the degree of accidents according to the length of service. Mr. Fell now handed in figures which showed that in the great majority of the accidents motormen had under three years' tramcar driving experience. Out of a total of 2,634 motormen 2,211, or 83·94 per cent., had had previous experience of street traffic as drivers of horse vehicles, such as tramcars, 'buses, vans, etc.

As to the police prosecutions of drivers for exceeding the speed limit, the following figures were given for the year 1912: January, 6; February, 12; March, 10; April, 16; May, 4; June, 2; July, 7; August, 9; September, 13; October, 8; November, 42; and December, 29; or a total of 158 prosecutions. The chairman, at this point, remarked that the London County Council drivers seemed to have been specially contumacious since the Committee commenced their sittings, but Mr. Fell thought it was due to the fact that the police had been watching them more carefully. He had never had, he said, to discharge a driver for exceeding the speed limit, although if a man were being continually charged by the police, it would, of course, tell against him. He also handed in to the Committee the schedules of times on the various routes, which show that there is an ample margin below the Board of Trade speed limits.

Mr. Fell presented the appended approximate return of the length of London County Council tramway on which the various Board of Trade speeds are allowed:

Speed in M.P.H.		Street Miles.	Percentage to total.
20	(Kingsway Subway).	⅓	0·2
16		78¾	56·1
14		¾	0·5
12		39¼	28·0
8		9¾	7·0
6		8	5·7
4		3½	2·5
	Totals	140⅓	100·00

Regarding the time worked by the men, the Committee necessarily regarding this as of importance from the point of view of public safety, Mr. Fell pointed out that in 1900 the average spread-over time was 14 hours 1 minute, the relief was 3 hours 5 minutes, and the average time actually worked, 10 hours 56 minutes. In 1907 the average spread-over time was 12 hours 26 minutes, the relief was 3 hours

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6 minutes, and the average time actually worked 9 hours 20 minutes. In 1910, the figures were 12 hours 15 minutes, 3 hours 9 minutes, and 9 hours 6 minutes respectively, whilst at the beginning of the present year the times were still further reduced to 11 hours 57 minutes, 3 hours 11 minutes, and 8 hours 46 minutes. The regulations were framed that there should be not less than 8 hours' rest, although Mr. Fell admitted that on Sundays perhaps there might be one or two occasions on which this did not happen.

Some discussion took place with the members of the Committee, and Mr. Will Thorne, M.P., was specially keen upon this, as to the possibility of doing away with the split-turn system, but Mr. Fell pointed out how impossible this would be under London conditions, although it is possible in some provincial towns where there is a heavy mid-day traffic. He himself, and, in fact, all tramway managers would, he said, be in favour of the abolition of the split-turn duty if it were possible. He agreed with Mr. Thorn that in one or two cases the men had been dissatisfied with the time-table, and mentioned a case which was brought up before the Conciliation Board, in which the Council offered to allow the men to put up their own time-table for a particular road. After two or three weeks a time-table was produced by the men's representatives, but it was agreed by the men themselves that it was a worse time-table than that of which they had previously complained.

What Trail Cars Would Accomplish.

Mr. Fell dealt with the question of trail cars, which he maintained would largely reduce accidents in the streets. He complained of the attitude of the police before the House of Commons Committee last year, which had resulted in the curtailment of the powers asked for by the Council in respect of trailers, and emphasised the point that Supt. Bassom had been compelled to admit before the Committee that the whole of his evidence was based on theory, and that he had, in fact, never seen a trail car in operation. On the other hand, the Council had brought evidence from many cities on the Continent, and also from Grimsby, to demonstrate how successful trail cars could be worked, and how useful they were in dealing with the traffic. Among the advantages which he enumerated were the possibility of the uniformity of service throughout the day, and the greater ease for dealing with the traffic at rush hours, by reason of there being three entrances instead of one, *i.e.*, two on the trail car and one on the motor car. Further, two cars coupled together occupied less space on the road and held up traffic less at junctions, and increased the carrying capacity per traffic unit.

At present the Council have only two trail cars at work, and these are put on the Woolwich lines to deal with the Arsenal workmen. So far as the driver was concerned, the use of trail cars would enable the abolition of the split duty, as the men could be continuously employed throughout the day, *i.e.*, only one driver was required for the motor car and trailer, and of course, the motor car would be in continuous operation all day, with the trailer put on at rush times. Thus the working day could be split up between two drivers, without the necessity for relief between their working hours. Mr. Thorne, it may be pointed out, however, whilst previously disagreeing with the adoption of the split-turn duty, now complained of its abolition, for the reason that he foresaw a reduction in the number of drivers through the adoption of trail cars. Mr. Fell agreed with this, and further pointed out that it would enable the Council to economise enormously in capital expenditure. He expressed the hope that when the County Council had had sufficient experience Parliament would grant them powers to use trail cars throughout their system.

Car and Motor Omnibus Comparisons.

Mr. Fell then entered into some comparisons between tramcars and motor omnibuses, starting off from the point that motor 'buses are unnecessarily being placed upon thoroughfares which are already adequately served by tramways, and he gave the results of some observations which have forced him to the conclusion that although by far the greater number of passengers on any particular route served by 'buses and tramcars are carried by the latter, yet the normal service of tramcars is amply sufficient also for all the people who travel by the 'buses. For instance, a census taken on one day on Canal Bridge, Cambridge Road, showed that there were 379 'buses and 835 cars, and that the 'buses carried 3,187 passengers, whilst the tramcars carried 16,606. The average number of passengers carried per 'bus was 8·409, whilst a similar figure for the cars was 19·883, and, argued Mr. Fell, seeing that the maximum number of passengers which a tramcar could carry was 78, it was clear that there was plenty of room on the cars for everybody who travelled on the 'buses, and without a single addition to the ordinary normal car service. Two other instances were given of a census taken from this point of view. At Camden Road, between 7 a.m. and 12 midnight on another day, 924 'buses and 1,065 tramcars were observed, the 'buses carrying 5,006 passengers and the cars 17,861. The 'buses carried on an average 5·354 passengers per 'bus and the cars 16·771. At Garrett Lane, between 5 a.m. and 12-30 a.m., 382 'buses were observed and 734 tramcars, the 'buses carrying 3,159 passengers and the cars 12,861. The number of passengers carried per 'bus was on the average 8·27, and on the cars 18·884.

This showed, argued Mr. Fell, that there are an unnecessary number of passenger-carrying vehicles in the streets. Mr. Fell's further comments on this question were first of all that omnibuses occupy more than twice the road space per passenger than the tramcar. Assuming 300 people to be carried, 19 'buses would be required in wet weather, as the uncovered top decks would not be used, whilst in dry weather 9 'buses would carry this number of passengers. On the other hand, only four double-deck tramcars would be required, be the weather wet or fine. Another point in favour of the car was that a tramcar occupies 34 ft. of road space, or 0·436 ft. passenger capacity. On the other hand, two motor 'buses would be necessary to carry the same number of people, and these two, assuming they were close up, which would be impossible, would occupy 46 ft. of road space. It would be necessary, he said, to allow a safety space of 10 ft. between the vehicles, and thus the length of road occupied by them would be 56 ft., or 0·823 ft. per passenger capacity. This applied to dry weather, but in wet weather five 'buses would be necessary, and in that event the road space occupied would be five times as much as that occupied by the tramcar to carry the same number of passengers.

How to Improve Traffic Conditions—Police Interference.

An interesting diagram was also exhibited to the Committee, showing the diminution in the number of passenger-carrying vehicles down Cheapside if the present 'buses could be supplanted by tramways. The point chosen was between St. Paul's Churchyard and the Mansion House, the number of vehicles, of course, being reduced in similar proportion to those mentioned above.

In the course of his evidence on April 3, Mr. Fell advocated the erection of a greater number of refuges, especially at tramway stopping points, and commented upon the handicap which the London tramways suffer from by the number of dead ends at busy points. These stopped at places where the majority of passengers did not wish to alight, and the fact that they had to change into another vehicle created great danger. He also complained of the dual system of supervision exercised by the Board of Trade and the police in regard to tramways, and suggested that, inasmuch as, in his opinion, the brakes on all public service vehicles were efficiently maintained by experts, the present inspection by the police could well be abolished. At any rate, police inspection of brakes in the streets he considered of no value, and he was quite prepared for the police to come into the car sheds and test the brakes in the presence of a competent man belonging to either the tramway, cab, or 'bus undertaking. Another practice of the police which was strongly condemned was that of holding up any vehicle, car or 'bus, in the event of an accident, at the point were the accident occurred, until the arrival of a certain official from Scotland Yard. He mentioned several instances in which tramcars, having been in collision, were not allowed to move for periods ranging from one and a half to three hours owing to the difficulty of finding this particular official at Scotland Yard. This, he said, is a practice not followed in the provinces, and was a source of danger, inasmuch as it held up the whole of the tramway traffic and caused obstruction to other traffic on the streets.

Mr. Fell made the following suggestions for improving traffic conditions in London: (1) All matters relating to the construction and maintenance of tramways should be placed under the Board of Trade; (2) regulations should be made requiring slow-moving traffic to keep to the kerb in all main thoroughfares (this is now to be dealt with under a by-law); (3) omnibuses should be prohibited from passing in between tramcars and the kerb, and obstructing the entrances and exits to tramcars at stopping places; (4) more stringent regulations should be put into force with regard to trade vehicles standing in front of business premises, especially in main thoroughfares. This practice should be prohibited at certain times of the day; (5) omnibuses should be prohibited from standing in public thoroughfares longer than necessary for taking up and setting down passengers; (6) regulations should be put into force requiring traffic emerging from side streets to give way to traffic in main thoroughfares; (7) the police regulations requiring public vehicles to be held up after an accident should be considerably modified; (8) refuges should be provided at all tramway stopping places where there is room for more than two lines of traffic between the car and the kerb; (9) Board of Trade stopping places for tramways should apply to all motor vehicles; (10) cab ranks should be abolished in all main thoroughfares; (11) the extension of tramways and the abolition of tramway dead-ends wherever possible.

The Question of a Traffic Board.

Mr. Thorne, M.P., asked Mr. Fell for his opinion as to why there were so many omnibuses on the road; was it due to an insufficent tramway service. Mr. Fell's reply was that there is quite a sufficient tramcar service, and that the reason why the 'buses are patronised to the extent they are is because they are able to take people to where they want to go, whereas in many cases the tramways, owing to the operation of the borough council veto, were obliged to stop short of the places to which passengers naturally desired to go. He pointed out that the Royal Commission on London Traffic had recommended the construction of 35 miles of tramways, but only four of these had been completed up to date. If the veto of the local authorities could

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be abolished, there would be a very large extension of the tramways, which would considerably relieve any existing danger points.

Mr. Fell also expressed the opinion that the present ratio between motor 'bus and tramway speeds, namely, 12 and 16 miles per hour respectively, is a good one, having regard to the greater safety of the tramcars, and he pointed out that if the 'bus speeds are to be increased the tramway speeds should be increased in like proportion. At the same time, he advocated a system of graduated speeds for all classes of traffic similar to that on the tramways, and further expressed himself in favour of a Central Board, advised by an expert committee, for dealing with London traffic. A remark of some interest was that relating to a scheme for extending the Hampstead Road tramways down Tottenham Court Road to Cambridge Circus, and either running the cars round this in a loop or running them at the back of the National Gallery out of the way of the general traffic.

The Committee adjourned.

THE GENERAL ELECTRIC COMPANY'S "AT HOME."

On March 15 the directors of the General Electric Company, to commemorate the twenty-fifth anniversary of the founding of the firm, gave an "At Home" to their numerous friends at the Royal Opera House, Covent Garden. The departure from the usual form of entertainment, *i.e.*, the set public dinner, was, we feel sure, much appreciated by the large number of guests who enjoyed the hospitality of Mr. Hugo Hurst and his fellow directors. For some years past the General Electric Company's annual dinner has been an occasion of considerable importance in the electrical field, not only by reason of the excellence of the entertainment provided, but for the gathering together of notable personages from various parts of the world whose views upon current topics have been of distinct interest. In view of the fact, however, that the number of guests has increased year by year and that intermingling has been practically impossible owing to the form of entertainment and the crowded state of the rooms, it has been felt that a departure from the orthodox dinner would be most desirable and lead to greater enjoyment for all concerned. The "At Home," which was held at Covent Garden Opera House, was the alternative which the directors decided upon, and we heartily congratulate Mr. H. C. Palmer, the organising manager, and all those who were responsible for the arrangements, which were complete in every detail, and ensured that the wishes of the company, as expressed on the cover of the "souvenir," viz., that all would spend a very pleasant evening, would be fulfilled.

The invited guests numbered 2,500, and included a large number of ladies, who were accommodated in the boxes and balconies. The seats for the gentlemen were arranged at some 80 small tables in the auditorium, each table being in charge of a steward drawn from the members of the G.E.C. staff (both at home and abroad), whose duty was the care and comfort of his particular guests. Ample provision for smokers was made at each table, while the wishes of each guest received immediate attention. Refreshments were served throughout the evening, buffets being provided in various parts of the house for the purpose, where an elaborate and appetising menu was provided.

The musical part of the programme consisted of a special orchestra of some 60 performers, under the direction of Mr. Herman Fink, and a select company of the leading artistes and humourists of the day. The series of bioscope pictures depicting the various works, offices, etc., of the company, formed a most interesting section of the entertainment, and judging by the applause which greeted the various views was an extremely popular feature. The first series of pictures were of the works at Witton, "Peel Corner," Salford, and "Ileene," Birmingham, a general view of Witton showing the extent of the present factory, including the main engineering works, carbon works, conduit works, and general store. This film was followed by various scenes depicting the interior of the various shops and illustrating the actual operations performed in each. A panoramic view taken from the travelling crane in the main engineering shop was of special interest, while a coloured view taken in the foundry, showing the casting of a turbo-generator bed, was quite the best thing of the kind we have seen. Other views showed machine tools at work, the various operations in the manufacture of carbons, the drawing of steel conduits, and electric welding. Views were also given of the operators leaving the factory, and again in the playing fields.

The Magnet Club, with its recreation rooms, tennis courts, football field, etc., was a popular subject, special interest being given to the series by the inclusion of the Witton football team which this year has an unbeaten record. The pictures of Peel Works illustrated the manufacture of the various parts of the telephone plant to which these works are entirely devoted. The series of views taken at Ileene works showed the various operations in the manufacture of art metal work, electrolier pendants, etc., and also the production of electric cooking and heating apparatus, the demand for which is so rapidly increasing. The second series of pictures was taken at the company's lamp works at Hammersmith, and related both to the Osram and Robertson lamp factories. The views showing the operators at work in the various departments in each of the works were followed by a display by the works' fire brigade. At irregular intervals it is the practice at these works to have a full fire drill, an alarm is sounded, and without previous notice the whole of the 2,000 operators are outside the building in 2½ minutes. The picture showed this complete drill and also an inspection of the firemen by Mr. Hugo Hurst. Two other series of pictures were shown, one designed to show the world-wide nature of the company's ramification and embracing their foreign and colonial offices, and the other to give some idea of the work at their head-quarters in London.

ENERGY CONSUMPTION IN TRAMWAY WORKING.

One of the tables introduced to illustrate the contention advanced in the article upon "Energy Consumption as a Measure of Maintenance Costs in Tramway Working," which appeared in our issue of March 13, was affected by two errors of inadvertance. The figures applying to Huddersfield were transposed, those belonging to the first column being placed in the second and *vice versa*, while two lines lower down the name Manchester was printed instead of Newcastle-on-Tyne. These alterations but slightly affect the average figures for the group of tramway systems dealt with in the table, which serve to illustrate that energy consumption is a better measure of maintenance cost in tramway working than is car-mileage.

FINANCIAL REPORTS AND MEETINGS.

British Aluminium Company.—Out of a surplus of £28,181 the directors recommend that a dividend of 6 per cent. per annum, less income tax, be paid on the preference share capital, leaving to be carried forward £10,206.

Croydon Tramway Revenue to Reduce Rates.—£3,000 each has been taken from the surplus revenues of the tramways and electricity undertakings and £7,000 from the water supply profits in order to keep the Croydon rates at 7s. 4d. in the pound.

Jarrow and District Electric Traction Company.—The accounts for 1912 show a divisible balance, after providing for debenture interest and placing £700 to renewals account, of £2,867. A dividend of 2 per cent. is proposed, adding £1,025 to depreciation and reserve account, and leaving £843 to be carried forward.

Tynemouth and District Electric Traction.—For the year ended December 31, 1912, the total revenue amounted to £13,661. A sum of £4,929 is available for distribution. The directors have placed £1,250 to reserve, and recommended that a dividend of 5 per cent. be paid on the cumulative preference shares and a dividend of 4 per cent. on the ordinary shares, and that the balance of £297 be carried forward. The renewals fund and reserve now amount to £19,502.

British Insulated and Helsby Cables.—The directors recommend a final dividend of 6s. per share, making, with the interim dividend already paid, 10 per cent. for the year. They propose to place £90,000 to reserve and depreciation, leaving about £74,000 to carry forward. Presiding at the annual meeting, held at Liverpool on March 17, Dr. E. K. Muspratt said the profit of £218,394 was an increase of £30,136. The prospects of trade in general continued good. The sum to be carried forward was £10,580 more than last year.

Mirrlees Watson Company.—At the annual meeting of the Mirrlees Watson Company, Limited, held at Glasgow on March 24, the accounts submitted showed a profit for 1912 of £36,580. After providing for depreciation and directors' fees, and adding the balance brought forward from the previous year (£2,478), a sum of £35,198 was left. The meeting resolved that £17,656 be applied in payment of a dividend of 10 per cent. and a bonus of 5 per cent., both less income tax, that £12,500 be transferred to general reserve account, and £5,042 be carried forward to the credit of the current year.

Paisley District Tramways.—At the ordinary general meeting, Mr. O. H. Smith, who presided, in moving the adoption of the report, said that the traffic receipts for the half-year were £1,113 in excess of the corresponding half-year of 1911. Unfortunately, the expenses were very heavy, and the gross profit showed a reduction of £670. The additional services run during the half-year involved increased charges for electrical energy and for traffic wages, and the cost of maintaining the rolling stock was heavier. Local rates were £250 in excess of the amount for the second half of 1911. The report was adopted.

Para Electric Railways.—Presiding at the annual meeting of the Para Electric Railways and Lighting Company on February 28, Sir W. Evans Gordon said that the report was the most satisfactory ever laid before the shareholders. They were able to show the substantial decrease in total operating expenses of £17,317. The total net earnings for the year, after paying all expenses in connection with Para and London offices, amounted to £133,038. To this must be added, "difference in exchange, etc.," £2,090, and £1,442 brought forward. After paying of the debenture interest and sinking fund

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TRAMWAY AND OMNIBUS SHARE LIST.

Specially Compiled for "The Tramway and Railway World."

Amount Ranking for Dividend.	Shares.	Name.	Div'd. Prev. Half-year.	Div'd. Last Half-year.	Quotations, Mar. 31.	Movement During Mar. Rise.	Movement During Mar. Fall.	Latest Business Done. Price.	Latest Business Done. Date.	Yield on Buying Price. £ s. d.	Dividend Due. (Final in Italics.)	Quotations, Jan., 1908, to Mar. 31, 1913. Highest	Quotations, Jan., 1908, to Mar. 31, 1913. Lowest
640,000	5	Anglo-Argentine Tramways 5½% Cum. 1st Pref.	2/9	2/9	4 13/16—5 1/16	...	— 1/16	4 29/32	Mar. 31	5 8 9	Jan., Dec.	5 13/32	4 1/4
500,000	5	Do. do. 5½% Cum. 2nd Pref.	2/9	2/9	4 3/8—4 1/2	...	...	92/6	Mar. 25	5 15 9	June, *Dec.*	5 13/32	4 7/16
1,500,000£	...	Do. do. 5% Deb. Stock Red.	5%	5%	98—100	...	— 1/8	99 3/8	Mar. 31	5 0 9	June, Dec.	105 1/2	96
325,532£	Stk.	Auckland Elec. Trys. Co. 5% Mort. Deb. ...	5%	5%	101—103	...	...	103	Mar. 17	4 18 0	Jan., July.	107	101
75,000	1	Bath Electric Tramways 5% Cum. Pref. ...	6d.	6d.	1/16—3/16	...	...	14/6	Dec. 31	6 3 3	*Jan. & July*	7/16	7/16
334,696£	Stk.	Birmingham Dist. Pow. & Tract. 4½% 1st Deb....	4½%	4½%	88—90	...	— 1	91 1/2	Dec. 17	5 0 0	Jan., July.	96	77
15,000	10	Blackpool and Fleetwood Tramways	4/-	9/-	13 3/8—14 1/8	...	...	14	Mar. 10	4 12 0	Feb., Aug.	14 1/2	12
60,000	10	Bombay Elec. Supply & Trys. Co. 6% Cum. Pref.	6/-	6/-	11—11 3/4	...	...	11 1/2	Mar. 7	5 2 3	Feb., Aug.	12 1/4	7 3/8
1,003,614	$100	Brazil Traction...	6	6	100—102	+ 3	...	101 1/2	Mar. 31	6 1 3	Fb.My.Ag.Nv.	105 1/2	90 1/2
75,000	5	Brisbane Elec. Tramways Investment Co. Ord.	4/-	4/-	7 1/8—7 5/8	...	...	7 5/32	Mar. 25	5 5 0	*May*, Oct.	9 1/2	3 3/16
75,000	5	Do. do. do. 5% Cum. Pref.	2/6	2/6	4 7/8—5 1/8	...	...	5 1/16	Jan. 10	4 15 3	*May*, Nov.	5 3/8	4 3/8
50,000	10	Bristol Tramways and Carriage Co.	4	4	5 3/4—6 1/4	...	— 1 3/4	5 1/8	Nov. 9/10	6 8 0	*Feb.*, Aug.	14 1/2	5
50,000	10	Do. do. do. 4% Cum. Pref.	4	4	7 1/4—7 3/4	...	...	7	Sept. 30	5 3 3	Jan., Julv.	9 1/4	6 3/4
800,000£	Stk.	British Columbia Electric Railway Def. Ord. ..	8%	8%	131—136	...	— 7	134	Mar. 31	5 17 9	May, Nov.	156	123
800,000£	Stk.	Do. do. Pref. Ord.	6%	6%	112—117	...	— 7	114	Mar. 31	5 2 9	May, Nov.	132 1/2	105
800,000£	Stk.	Do. do. 5% Cum. Perp. Pref.	5%	5%	103—106	...	— 2	105	Mar. 31	4 14 9	May, Nov.	114	99
1,070,097£	Stk.	British Electric Traction Prefd. Ord.	...	...	9—11	...	— 1 1/2	9	Mar. 25	...	Apr., *Oct.*	16	10 1/2
403,503£	Stk.	Do. do. 6% Cum. Pref. ..	6%	6%	85 1/2—88 1/2	...	...	87 1/2	Mar. 31	6 15 9	Feb., *Aug.*	95 1/2	85 1/2
1,464,245£	Stk.	Do. do. 5% Perp. Deb. ...	5%	5%	88 1/2—92 1/2	...	— 2 1/2	89 1/2	Mar. 31	5 8 3	April, Oct.	101	82 1/2
439,796£	Stk.	Do. do. 4½% 2nd Deb. Red. ...	4½%	4½%	75—79	...	— 2	77	Mar. 31	5 17 0	May, Nov.	84	58
246,625£	Stk.	Buenos Aires Port & City Trys. 6% 1st Mt. Deb.	6%	6%	92—96	...	...	95	Mar. 7	6 6 6	Feb., Aug.	103	61
623,270£	Stk.	Buenos Ayres Lacroze Trys. Stg. 5% 1st Mt Deb.	5%	5%	99—101	+ 1 1/2	...	100 1/4	Mar. 31	4 19 0	Mar., Sept.	103	89
137,610	5	Calcutta Tramways Ord.	4/6	2/6	5 3/8—6 1/8	...	...	6 1/16	Mar. 18	5 12 0	*Apr.*, Oct.	7 1/4	4
47,295	5	Do. 5% Cum. Pref.	2/6	2/6	4 13/16—5 1/16	...	...	4 15/16	Mar. 26	4 18 9	Jan., July	5 3/8	4 3/8
491,222	1	Cape Electric Tramways	1/-	for '12	1/16—3/16	+ 1/16	...	15/3	Mar. 27	6 3 3	Feb., *Nov.*	1 3/16	3/8
15,000	10	Carthagena and Herrerias Steam Tramways ...	5/-	Apr. '11	2 3/4—3 1/2	...	...	65/-	Nov. 21	...	April.	7	3
248,000	5	City of Buenos Ayres Tramways (1904) ...	2/6	2/6	5 7/16—5 11/16	...	— 1/16	5 13/32	Mar. 28	4 9 0	Fe My.Au No	6	5 1/8
120,000£	Stk.	Colombo Elec. Trys. & Ltg. 5% 1st Mt. Deb. ...	5%	5%	93—97	...	...	96	Jan. 31	5 5 3	May, Nov.	101	87
11,500	10	Cork Electric Tramways and Lighting Co. ...	...	8/- ann.	4 1/2—5	...	...	4 15/32	Dec. 23	8 0 0	*Mar.*	10	4 1/2
12,327	10	Do. do. do. 5% Cum Pref.	5/-	5/-	7 1/2—8	...	...	8	July 22	6 5 0	Jan., July	10 3/4	7 1/2
3,000	10	Dublin and Lucan Elec. Railway 5% Cum. Pref.	5/-	5/-	8 1/2—9xd	...	...	9	Aug. 25/10	5 11 3	Sep.15, Mar.15	9 1/4	6
60,000	10	Dublin United Tramways Co. (1896), Ltd., Ord.	6/-	6/-	11—11 1/2	...	...	11 7/16	Mar. 31	5 4 6	Feb., Aug.	14	11
60,000	10	Do. do. do. 6% Cum. Pref.	6/-	6/-	11 3/4—12 3/4	...	...	12 3/8	Mar. 28	4 14 3	*Feb.*, Aug.	14	11 1/2
13,500	10	Gateshead & District Trys. Co. Ord.	5/-	9/-	8 1/2—9	...	— 1/4	8 1/2	Mar. 31	7 15 0	*Mar.*, Sept.	9 1/4	7 7/8
268,235	10/-	Hastings and District Elec. Trys Ord.	...	...	1/32—3/32	...	...	1/9	Jan. 5/12	...	...	3/16	1/32
80,000	1	Do. do. 6% Cum. Pref. ...	6%	6%	5/8—3/4	...	...	12/6	June 6	8 0 0	...	3/4	5/32
125,000£	Stk.	Do. do. 4½% Deb. Stk. Red.	4½	4½	66 3/4—71 3/4	...	— 2 1/4	73 1/4	Feb. 8/12	6 5 6	April, Oct.	100	69
$9,634,000	$1,000	Havana Elec. Rly. Co. Con. Mort. 5%	5%	5%	97—101	...	— 2	97 13/16	Mar. 29	5 2 0	Feb., Aug.	105	80
195,000£	100	Hong Kong Tramways Co. 5% Mt. Deb. ...	5%	5%	86—90	...	...	89	Mar. 17	5 12 6	May, Nov.	92	75 1/2
20,000	10	Imperial Tramways Ord.	Nil	Nil	4 1/2—5 1/2	...	...	9 3/4	Oct. 29/09	...	Feb., Aug.	9 3/4	2 1/4
20,000	10	Do. 6% Cum. Pref.	Nil	Nil	8—8 1/2	...	...	6 7/32	Ju. 28/09	...	Jan., July.	9 1/2	2 1/4
30,000	5	Isle of Thanet Elec. Try. & Ltg. Co. 5% Cum. Pref.	2/6	Dec. '12	2 1/8—2 3/8	...	...	46/3	Nov. 30	4 15 3	*Mar.*, Sept.	3	3/4
250,000	1	Kalgoorlie Electric Tramways	...	...	1/32—3/32	...	...	1/-	Jan. 15/12	...	*May*	3/16	1/32
170,000	1	La Plata Elec. Trys. Co. 6% Cum. Pref. ...	7½d.	Oct. '11	3/32—1	...	...	19/9	Jan. 21	...	*April*, Oct.	1 1/16	1/4
30,800	10	Lanarkshire Tramways	5/6	6/-	9 3/4—10	...	...	10	May 27	5 15 0	Feb., Aug.	10 9/16	9 1/2
250,000£	Stk.	Lancashire United Trys. 5% Prior Lien Deb....	5%	5%	78—80	...	...	78 1/2	Mar. 26	6 6 9	Jan., July.	95	78 1/2
634,026	1	Lisbon Electric Tramways Ord.	7½d.	7½d.	1 3/16—1 5/16	...	...	24/-	Mar. 10	4 11 6	*July.*	1 9/32	3/8
425,553	1	Do. do. 6% Cum. Pref ...	7½d.	7½d.	1 1/16—1 1/16	...	...	22/6	Feb. 15	5 1 3	Jan., July.	1 1/4	7/16
1,000,000£	Stk.	London General Omnibus 4½% 1st Deb.	...	4 1/2	94—96	...	...	95 1/2	Mar. 31	4 14 9	Jan., July.	98	93 1/2
1,000,000£	Stk.	Do. do. 5% Cum. Income ...	...	5	89—91	...	— 1	90 1/4	Mar. 31	5 8 0	Feb., Aug.	94	89
125,000	10	London United Trys. (1901), Ltd., 5% Cum. Pref.	2/6	Dec. '08	4 1/4—5	...	...	5 1/8	Dec. 5	...	*Jan.*, July.	8 1/2	1 3/8
63,430£	Stk.	Madras Elec. Trys. (1904) Ltd. 5% Deb. Red. ...	5%	5%	102—104	+ 1	...	102 3/4	Mar. 7	4 16 6	Jan., July.	102 3/4	86
300,000£	100	Manaos Trys. & Ltg. Co. 5% 1st Debs.	5%	5%	87—90	...	...	88 3/4	Mar. 12	5 12 6	Jan., July.	97	86
$4,785,000	$1,000	Manila Elec. R. R. and Ltg. Corp. 5% Gld. Bds.	5%	5%	98—100	...	...	98	Mar. 13	5 0 0	Mar., Sept.	104 3/8	84
60,000	1	Mansfield & District Trys. Ltd. 6% Cum. Pref.	7½d.	7½d.	1 3/16—1 5/16	+ 1/32	...	19/3	Sept. 5	5 13 0	Mar., Sept.	1 5/32	3/4
395,832	1	Metropolitan Electric Tramways Ord.	7	5	3/32—1 1/32	...	...	21/3	Dec. 10	5 16 6	*April*, Oct.	1 3/8	3/8
78,504	1	Do. do. do. (New)... ...	...	...	3/32—1 1/32	...	...	...	...	...	...	1 5/32	5/32
500,000	1	Do. do. do. 5% Cum. Pref.	6d.	6d.	1/16—1/8	...	— 1/32	14/-	Mar. 13	6 3 3	*Feb.*, Aug.	1 5/32	1/8
$16,487,400	$100	Mexico Tramways Common Stock	$3½	$3½	111—113	+ 4	...	111 1/2	Mar. 31	6 7 3	Fb.My.Au.No	151 1/2	65
$3,840,000	...	Michigan Untd Rys. Co. 5% 1st Debs & Refdg Bds	5%	5%	95—95	...	...	93 3/8	Mar. 20	5 8 6	May, Nov.	101 1/2	92 1/4
600,000£	100	Montreal Street Rly. 4½% Ster. Debs.	4½%	4½%	98—100	...	...	98 1/2	Mar. 7	4 10 0	Fe.My.Au.No.	107	98
5,000	10	Oldham, Ashton, and Hyde Elec. Tramways Ord.	5/-	...	6 1/4—7 1/4	+ 1/8	...	6 1/2	Oct. 8	...	Mar., Aug.	9 3/4	6 3/4
5,000	10	Do. do. do. 5% Cum. Pref.	5%	5%	6 3/8—6 5/8	+ 1/8	...	6 17/32	July 8	7 11 0	Feb., Aug.	8 1/2	6 1/4
77,893	5	Para Elec. Rly. and Ltg. Co., Ord.	5/-	5/-	7—7 1/2	...	— 3/8	7	Mar. 29	6 13 6	May, Nov.	8	6
100,000	1	Perth (W.A.) Electric Tramways Ord.	6d.	7½d.	1 3/32—1 1/32	...	...	25/6	Nov. 8	4 2 9	*Sept.*, Nov.	26/3	3/4
245,000	1	Potteries Electric Traction Ord.	3 1/2	for '11	5/16—7/16	...	...	7/6	Dec. 2	8 0 0	April.	3/4	1/8
245,000	1	Do. do. 5% Cum. Pref. ...	6d.	6d.	3/32—5/32	...	...	13/-	Mar. 19	6 13 6	*Feb.*, Aug.	1/4	1/16
124,560	1	Provincial Tramways Ord.	8d.	10d.	1/16—1/8	...	...	16/-	Mar. 28	9 4 3	May. *Nov.*	1 1/16	13/-
10,000	10	Do. do. 6% Cum. Pref.	6/-	6/-	9 3/8—9 5/8	...	...	9 9/16	Mar. 3	6 4 9	June, *Dec.*	11	9
50,000	5	Rangoon Elec. Trys. & Supply Co. 6% Cum. Pref.	3/-	3/-	5 3/8—5 5/8	...	...	5 13/32	Aug. 31	5 2 3	June, Dec.	6	5
100,000	$100	Sao Paulo Tramway, Light, and Power Co. ...	$5	$5	...	...	...	280	Sept. 30	...	Ja.*Ap.*Jul.Oc.	290	110
32,000	10	Shanghai Elec. Construction Co.	...	...	7 3/4—8 3/4	+ 1/4	...	8	Nov. 28	...	May.	11 1/2	6
330,400£	Stk.	Singapore Elec. Trys. Ltd., 5% Debs. Red. ...	5%	5%	83 1/2—87 1/2	...	— 2 1/2	89	Mar. 17	5 14 3	Mar., Sept.	89	61
169,570	1	S. Metrop'n Elec. Trys. & Ltg. Co. 6% Cum. Pref.	1/2 3/8	May, '12	1/16—1/8	...	...	15/9	May 16	7 7 9	Feb., Aug.	1 1/8	3/8
91,720£	Stk.	Southern Elec. Trys. of B.A., 1st Mt. Deb. ...	5%	5%	95 1/2—97 1/2	...	— 1 1/2	96	Mar. 6	5 2 9	Feb., Aug.	100	90
160,000£	100	Sunderland District Elec. Trys. 5% 1st Mt. Debs.	5%	5%	...	...	...	58 3/8	June 1/10	...	Jan., July.	88	58 3/8
471,500£	100	Toronto Ry. Co. 1st Mt. 4½% Stg. Bonds ...	4½%	4½%	96—98	...	— 1	99	Nov. 8	4 12 0	Feb., Aug.	104	97
80,000	5	United Elec. Tramways of Monte Video, Ord....	4/-	3/-	5—5 1/2	...	— 1/4	5 1/8	Mar. 25	6 7 3	*June*, Dec.	6 1/2	5
90,000	5	Do. do. do. 6% Cum. Pref.	3/-	3/-	4 7/8—5 3/8	...	...	5 5/16	Mar. 28	5 11 9	June, Dec.	6 5/8	4 5/16
500,000£	Stk.	Winnipeg Elec. Rly. Co. 4½% Perp. Cons. Debs.	4½%	4½%	98 1/2—101 1/2	...	— 2	99	Mar. 28	4 8 6	Apr., Oct.	109 1/2	98 1/2
40,977	5	Yorkshire (West Riding) Elec. Trys. Ord. ...	...	...	1/4—3/4	...	...	8/6	Oct. 31	...	*Mar.*	1 1/2	1/4
46,261	5	Do. do. do. 6% Cum. Pref.	1/6	1/6	2 1/8—3 3/8	...	...	65/-	Feb. 27	4 9 0	*Mar.*	3 3/4	1 3/4

ELECTRIC RAILWAY SHARES.

1,854,720£	Stk.	Central London Ord. Stock	3	3	78—80	+ 1	...	79 1/4	Mar. 31	3 15 0	*Feb.*, Aug.	89 1/2	59 7/8
572,640£	Stk.	Do 4% Pref. Stock	4	4	83—85	+ 1	...	83 1/4	Mar. 19	4 14 3	Feb., Aug.	92	80
572,640£	Stk.	Do. Deferred Stock	2%	for '12	78—80	+ 1	...	79 1/2	Mar. 31	2 10 0	Feb., Aug.	91 3/8	42
1,480,000£	Stk.	City and South London Cons. Ord. Stock ...	1 1/4	1/2	...	...	...	35 1/4	Dec. 23	...	*Feb.*, Aug.	46	25 1/2
78,000	10	Great Northern and City Pref. Ord. 4% ...	Nil	Nil	2 3/8—2 5/8	...	...	47/6	Mar. 14	...	*Feb.*, Aug.	2 7/8	3/8
50,000	10	Liverpool Overhead Ord.	2/-	2/6	3 9/16—3 11/16	...	— 1/16	72/6	Mar. 28	6 1 9	*Feb.*, Aug.	4	3/8
1,412,263£	Stk.	Mersey Cons. Ord. Stock	Nil	Nil	5—5 1/2	...	— 1/4	5	Mar. 8	...	*Feb.*, Aug.	8	1
5,732,062£	Stk.	Metropolitan Cons.	1 1/2	1 3/4	53 1/2—53 3/4	...	— 1 1/2	53 1/4	Mar. 31	3 2 3	*Feb.*, Aug.	75 1/8	34
2,640,914£	Stk.	Do. Surplus Lands Stock	2 3/4	2 3/4	61—63	...	...	61 1/2	Mar. 27	4 7 6	*Feb.*, Aug.	72	60 3/4
3,235,000£	Stk.	Metropolitan District Ord.	Nil	Nil	40—40 1/2	+ 2 1/2	...	40	Mar. 31	...	*Feb.*, Aug.	51 1/2	9 1/2
467,000	10	Underground Electric Railways Co. of London	...	...	4 1/2—4 1/2	...	— 1/8	88/9	Mar. 29	...	...	5 7/16	1 3/8
1,730,000£	...	Do. 4½% Bonds of 1933	4½%	4½%	97—99	...	— 1	97	Mar. 28	4 12 0	Jan., July	102	73
1,192,707£	...	Do. 6% 1st Income Debs.	6%	6%	109 1/2—111 1/2	...	— 2	110 1/2	Mar. 29	5 7 9	Mar., Sept.	117 1/2	110
6,120,750£	...	Do. 6% Income Bonds	40/-	60/-	92 1/2—93 1/2	...	— 2 1/2	93 1/2	Mar. 31	5 7 0	Mar., Sept.	97 1/2	18

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charges, there was left £98,070. The directors proposed to transfer £15,000 to reserve for depreciation and renewals, and set aside a further £15,000 for contingencies.

Record Grant in Relief of Rates.—Manchester Tramways Committee on March 11 decided that they would be able to make a contribution of £100,000 in relief of the rates, after allowing for depreciation, etc. Last year the amount was £85,000. It is pointed out that improvements have been made during the year in the conditions of service for tramway workers, and that there has been an adjustment and alteration of fares in favour of passengers. The penny stages have been lengthened, and the age raised for the payment of half fare. The sum mentioned as the rate relief contribution to be paid this year is stated to be the largest that has been contributed by any municipal undertaking. The service has been established 10 years, and has contributed altogether £700,000 in relief of the rates.

First Grant under the New Light Railways Act.—The Dingwall and Cromarty Light Railway promoters have secured the first grant made under the Light Railways Act of last session. Formerly the Treasury required promoters to produce guarantees for both the working and construction of the line, but the latter condition is not now obligatory, and the Treasury have decided to advance £48,000, partly by way of gift and partly as a loan. Now that the condition as regards the construction has been removed, the work is expected to be begun immediately. It has been agreed that the advances of the local authorities should have priority as to repayment over those of the Government. The total cost of the line is estimated at £96,000, and it is to be worked by the Highland Railway Company.

Greenock and Port Glasgow Tramways Company. In their report for the past year the directors state that with the reliable vehicles now available there is scope for a profitable service of motor 'buses in Greenock, and a service will be commenced in the spring of the present year. The total revenue for 1912 was £43,383, and traffic receipts £42,214, an increase of £4,267. After providing for expenses (including £2,137 for interest, payments to Corporations amounting to £1,448, and setting aside £4,000 to renewals account), the surplus is £13,296, making, with £1,072 brought forward, a total of £14,368. The directors propose to place £1,773 to reserve sinking fund and £1,200 to reserve, to pay the dividend on the 5 per cent. preference shares, and a dividend at the rate of 6 per cent. per annum on the ordinary shares, leaving £996 to be carried forward.

Rhondda Tramways Company.—The report of the directors for the past year shows a balance to the credit of the revenue account of £18,680. After deducting rent to the Rhondda Urban District Council, debenture interest, sinking fund for the redemption of debentures, interest on loan, etc., there remains £2,778. Adding to this £1,198 brought forward, there is an available sum of £3,976, which the directors recommend should be disposed of by placing £2,000 to reserve and renewal account and carrying forward £1,976. The profit for the year was adversely affected to the extent of at least £6,500 by the national coal strike and by the strike of the company's drivers and conductors in May. The company are promoting a Railless Traction Bill to enable them to serve a large and increasing colliery district about six miles from Tonypandy.

Keighley Corporation Tramways.—The report for the year ended March 31, 1912, bears the signature of Mr. D. Gray, who resigned recently on accepting a position abroad. The total revenue amounted to £9,839, an increase of £223 compared with the previous year. The average total receipts per car-mile were 9·721d., against 9·54d. last year, an increase of ·18d. per car-mile. The total number of passengers carried was 2,245,120, against 2,204,554 last year, an increase of 40,566 passengers. The passengers carried numbered 9·242 per car-mile, against 9·11 last year, an increase of ·13 per car-mile. The working expenses amounted to £5,984, against £5,656, an increase of £328. The working expenses per car-mile were 5·91d., against 5·61d. last year, an increase of ·30d. per car-mile. The number of car-miles run was 242,919, against 241,914 last year, an increase of 1,005 miles.

Guernsey Railway Electrification. An interesting review of the history of the Guernsey Railway Company, especially with reference to the electrification of the system and the adoption of the 12-minute service, both of which had proved successful and popular, was given by Mr. T. W. Palmer at the general meeting, and a dividend of 5 per cent. was declared. Mr. G. F. Peek, chairman, stated that a favourable contract had been entered into with the Electric Light and Power Company for the supply of power and current for a term of 10 years. Had a contract not been entered into the railway company would have been faced in the near future with a capital expenditure of from £2,000 to £3,000 for renewals to their own plant in the shape of dynamos and engines. Should the supply fail their own current would be available in a few hours. Votes of thanks were accorded to the manager and electrical engineer, Mr. C. G. Bird, to Mr. J. de Mouilpied, the secretary, and the staffs.

Record Profit by the Lancashire United Tramways.—The Hon. A. Stanley, M.P., presiding at the eighth ordinary meeting of the Lancashire United Tramways Company, said that the profit of the combined undertaking for 1912 amounted to £19,465, an increase of £281. The profit this year was the highest since the inception of the company. This had been obtained in spite of the disastrous coal strike, which had resulted in a considerable loss of receipts. The increase of £1,390 in receipts was made up as follows: Traffic receipts, £515; sale of electrical energy, £738; advertising on cars, £23; and sundry receipts, £114. The traffic earnings per car-mile amounted to 8·21d., and this figure was the highest yet obtained. The current year would show a further increase of units sold due to the fact that they had made arrangements to supply in the urban district of Tyldesley through the Lancashire Electric Power Company, and to the increased demand in Atherton and other districts. Owing to the increased load, it had become necessary to instal a new battery and turbine. The battery was already working at Hindley, and an order had been placed for a turbine set in ther main generating station.

The J. G. Brill Company.—The annual report of the J. G. Brill Company shows that the total sales value of the combined output of all the five plants of the J. G. Brill Company for the 12 months ended December 31, 1912, was $7,842,090. The comparative figures for the past five years are as follows:

1908 ...	$3,845,173	1910 ...	$5,960,778	1912 ...	$7,842,090
1909 ...	4,261,294	1911 ...	5,870,907		

The profit amounted to $1,054,851. The regular quarterly dividend on the preferred stock at the rate of 7 per cent. per annum has been paid, and during the year there was set aside out of earnings, in addition to the depreciation reserve, the sum of $135,826. Mr. S. M. Curwen, the president, remarks that in addition to the increase in domestic orders, there has been a substantial increase during the year in the company's foreign business. The amount of work executed during the year represented more nearly a normal output for the combined plants than any year's business since 1907. On February 1 the orders of the combined companies amounted to $4,140,689, and the outlook for the present year warrants the management in expecting a year of successful and profitable work.

Leicester Corporation Tramways.—The annual review of the work of the year ended December 31, 1912, includes reports of Mr. E. G. Mawbey, borough engineer and surveyor, who is in charge of the track; Mr. T. R. Smith, engineer and manager of the electricity department; and Mr. A. F. Lucas, the tramways manager. The report shows that the total receipts amounted to £147,671, and the working expenses to £95,029, leaving a balance of £52,642, or a decrease of £4,060 as compared with last year. The percentage of working expenses to receipts is 64, as compared with 60 in the previous year. After payment of interest, income tax, and providing for the redemption of debt, there is a net balance of £17,667. The passengers numbered 32,907,795, an increase of 1,593,453. Receipts averaged 9·675d. per car-mile, an increase of ·353d. per car-mile, and working expenses, 6·226d. The power-station works costs show a decrease; indeed, the generating costs per unit have been the lowest that they have ever been viz., ·5320d. per unit, and this has been achieved in spite of the fact that there was an advance in the price of coal last year of 1s. 5¾d. per ton. Energy consumption per car-mile amounted to 1·79 units per car-mile. The engineer, Mr. T. R. Smith, attributes the decrease in the cost to the use of the mixed-pressure steam turbine. Mr. Mawbey, the borough engineer, states that most of the track has now been in use for nearly nine years, and the wear on the permanent way is naturally becoming more noticeable. It has not been necessary hitherto to renew any considerable length of the permanent way, notwithstanding the heavy service over a large portion of it.

The London United Tramways, Limited.—The report for the year ended December 31, 1912, shows that the gross receipts amounted to £332,016, and the expenses to £223,654, leaving a balance of £108,361. Including the amount brought forward, the sum at the disposal of net revenue is thus £109,793. After payment of interest, and providing for income tax, there is a balance of £41,228. The directors propose to place £15,000 to general reserve, £25,000 to reserve for renewals and contingencies, and to carry forward £1,228. The gross receipts show a decrease of £11,971, and the working expenses an increase of £4,621, resulting in a decrease in net revenue of £16,592 as compared with the previous year. The number of passengers carried during the year was 61,139,285, a decrease of 1,407,843. The arbitrator's award in the matter of the purchase of the company's tramways in Hammersmith was issued in February of last year, and negotiations in regard thereto are proceeding with the London County Council. Pending the final settlement of this question, the County Council have agreed to make advances to the company for the reconstruction of portions of the Hammersmith tramways. The scheme for the consolidation of the company's interests with those of the Metropolitan Tramways, Limited, and the Tramways (M.E.T.) Omnibus Company, Limited, which was submitted to the shareholders in November last, was accepted. In accordance with the policy therein indicated the three companies have been placed under one management. Mr. James Devonshire has been appointed managing director in place of Mr. Stanley, who, however, retains his seat on the board.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls.	Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Loans Repaid and Sinking Fund.	Depreciation, Renewal and Reserve Funds.	Gross Receipts. Traffic.	Other.	Total.
Aberdeen ...	* May 31, 1912	Dec., 1899	E.	27	60	350,000	346,075	3,925	346,075	12,471	196,825	149,250	119,621	76,130	1,050	77,180
Accrington ...	* Mar. 31, 1912	Aug., 1907	,,	10	53	169,675	132,822	36,853	133,125	12,488	118,547	14,578	9,641	25,756	465	26,221
Ashton-u-Lyne ..	* Mar. 25, 1912	Aug., 1902	..	8	15	130,070	108,099	21,971	108,099	13,203	83,240	24,859	1,650	21,340	551	21,891
Ayr	* May 15, 1912	Sept., 1901	,,	7	49	128,000	74,405	53,595	82,914	10,892	64,417	16,078	14,028	15,092	660	15,752
Birmingham ...	* Mar. 31, 1912	Jan., 1904	,,	101	37	2,019,900	1,894,772	125,128	1,870,937	...	1,729,633	165,138	190,441	434,048	6,052	440,100
Blackburn ..	* Mar. 25, 1912	Mar., 1899	,,	24	63	408,174	342,474	65,700	334,924	13,512	260,622	152,472	1,000	60,283	2,847	63,130
Blackpool ...	* Mar. 31, 1912	June, 1899	,,	21	31	438,028	294,483	143,545	295,984	13,839	294,483	102,855	16,259	64,313	1,027	65,340
Bolton	* Mar. 31, 1912	Dec., 1899	,,	47	17	552,208	548,208	4,000	538,958	11,416	381,750	145,383	45,920	131,155	991	132,146
Bradford ..	* Mar. 31, 1912	July, 1898	,,	(h)101	74	1,269,568	978,063	291,505	965,366	9,471	635,883	355,633	75,120	274,328	15,007	289,335
Brighton	* Mar. 31, 1912	Nov., 1901	,,	17	15	279,070	274,905	4,165	274,905	15,994	229,717	40,174	5,834	52,144	1,884	54,028
Burnley	* Mar. 31, 1912	Dec., 1901	,,	21	5	388,052	278,032	110,020	209,348	9,939	168,989	50,161	47,430	72,454	255	72,709
Burton-on-Trent	* Mar. 31, 1912	Aug., 1903	,,	9	60	108,632	104,562	4,070	106,012	10,873	55,762	48,800	8,243	14,823	1,343	16,166
Bury	* Mar. 31, 1912	June, 1903	,,	21	14	407,800	280,195	127,605	283,005	13,365	263,345	36,932	19,419	66,074	141	66,215
				(b) 13	21											
Chester	* Mar. 25, 1912	April, 1903	,,	6	35	92,991	82,380	10,611	82,934	12,883	71,027	11,490	1,998	12,343	477	12,820
Chesterfield ...	* Mar. 31, 1912	Dec., 1904	,,	5	8	95,000	70,500	24,500	69,575	13,642	60,289	10,211	5,031	11,709	496	12,205
Colchester ...	* Mar. 31, 1912	July, 1904	,,	7	75	70,748	69,555	1,193	69,401	8,740	55,805	14,700	...	10,284	450	10,784
Croydon	* Mar. 31, 1912	June, 1906	,,	18	10	287,689	287,689	Nil	284,847	15,608	232,636	78,027	37,206	92,539	1,891	94,430
Darlington ...	* Mar. 31, 1912	June, 1904	,,	8	71	107,500	76,165	31,335	76,322	8,587	58,431	17,175	4,504	11,491	383	11,874
Darwen	* Mar. 31, 1912	Oct., 1900	,,	7	13	93,400	86,300	7,100	85,748	11,972	60,670	25,718	6,400	14,530	241	14,771
Derby	* Mar. 31, 1912	July, 1904	E.	22	5	...	...	...	242,476	10,999	191,798	50,678	(a) 4,005	E 46,388	975	47,363
			H.			...	...	...	...	...	...	...	...	H 407	18	425
Doncaster ...	* Mar. 31, 1912	June, 1902	E.	11	62	103,900	94,500	9,400	95,025	8,070	82,400	13,020	27	17,417	252	17,669
Dundee	* May 15, 1912	July, 1900	,,	27	38	...	341,416	...	349,854	12,734	266,161	77,173	60,984	62,016	664	62,680
East Ham ...	* Mar. 31, 1912	June, 1901	,,	14	32	189,524	187,073	2,451	...	191,260		50,374	...	57,342	668	58,010
Exeter	* Mar. 31, 1912	April, 1905	,,	7	0	106,000	86,111	19,889	86,111	12,301	71,325	15,243	4,925	17,290	Nil	17,290
Gloucester ...	* Mar 31, 1912	April, 1904	,,	15	2	191,000	144,243	46,757	147,692	9,846	113,280	14,587	...	15,894	1,108	17,002
Halifax	* Mar. 31, 1912	June, 1898	,,	54	20	450,313	402,735	47,578	403,255	7,433	302,139	95,385	21,561	100,884	1,010	101,894
Ilford	* Mar. 31, 1912	Mar., 1903	,,	11	28	149,633	149,633	Nil	149,136	13,140	114,806	34,827	7,648	27,294	2,272	29,566
Ilkeston	* Mar. 31, 1912	May, 1903	,,	4	24	64,214	47,000	15,074	47,936	11,148	42,600	11,919	350	6,533	156	6,689
Ipswich	* Mar. 31, 1912	Nov., 1903	,,	14	70	116,471	114,300	2,171	114,838	7,720	100,735	14,228	4,966	22,358	581	22,939
Keighley	* Mar. 31, 1912	Oct., 1904	,,	6	9	50,934	46,903	4,031	46,903	7,673	34,465	15,080	1,310	9,588	251	9,839
Kilmarnock ...	* May 15, 1912	Dec., 1904	,,	5	47	65,000	48,246	16,754	52,666	9,426	48,205	6,090	2,749	8,400	237	8,637
Kirkcaldy ...	* May 15, 1912	Feb., 1903	,,	8	65	213,000	92,581	120,419	96,749	11,041	77,885	14,696	3,643	15,584	481	16,063
Lancaster ...	* Mar. 31, 1912	Jan., 1903	,,	4	65	60,000	51,550	8,450	43,412	9,021	39,000	12,371	3,000	5,566	144	5,710
Leith	* May 15, 1912	Aug., 1905	,,	17	73	275,000	235,000	40,000	235,000	13,119	193,200	42,257	302	33,851	842	34,693
Leyton	* Mar. 31, 1912	Dec., 1906	,,	18	40	306,427	305,821	606	295,526	15,977	256,643	40,906	3,360	61,496	1,172	62,668
Lincoln	* Mar. 31, 1912	Nov., 1905	S.	2	77	98,519	44,940	53,579	44,992	15,187	44,168	8,587	1,488	6,688	126	6,814
Liverpool ...	* Dec. 31, 1912	Nov., 1898	E.	119	0	...	...	...	2,015,193	16,934	1,245,282	1,012,873	430,509	631,071	13,103	644,174
Lowestoft ...	Sep. 30, 1911	July, 1903	,,	5	39	84,230	79,235	4,995	79,235	14,439	68,933	11,373	Nil.	11,660	313	11,973
Maidstone ...	* Mar. 31, 1912	July, 1904	,,	7	3	82,932	82,582	350	78,748	11,012	69,158	13,424	Nil.	9,279	518	9,797
Manchester ...	* Mar. 31, 1912	June, 1901	,,	184	78	2,355,689	1,988,871	366,818	1,998,595	10,811	1,618,779	385,471	447,507	845,460	11,329	856,789
Nelson	* Mar. 31, 1912	Feb., 1903	,,	3	69	38,000	36,349	1,651	36,430	...	29,602	6,747	...	9,371	41	9,412
Newport (Mon.) ..	* Mar. 31, 1912	April, 1903	,,	14	35	219,250	193,250	26,000	192,934	13,363	166,653	35,432	9,958	36,361	821	37,182
Nottingham ...	* Mar. 31, 1912	Jan., 1901	,,	36	40	730,300	..	...	635,128	17,401	439,128	197,036	63,201	160,190	2,408	162,598
Oldham	* Mar. 25, 1912	May, 1902	,,	27	67	516,923	436,704	80,219	441,047	15,395	333,746	113,339	(a) 1,419	101,280	819	102,099
				(b) 8	31											
Perth	* May 15, 1912	Nov., 1905	,,	6	40	90,000	77,650	12,350	77,829	11,539	64,790	13,678	1,034	9,689	412	10,101(e)
Plymouth ...	* Mar. 31, 1912	Sept., 1899	,,	15	0	...	188,752	...	157,322	...	92,636	97,320	10,848	37,083	830	37,913
Pontypridd ...	* Mar. 31, 1912	Mar., 1905	,,	8	48	136,019	135,885	134	136,896	15,919	112,862	22,899	...	21,130	2,036	23,166
Rawtenstall ...	* Mar. 31, 1912	May, 1909	,,	15	71	196,159	182,933	13,226	181,036	11,401	169,971	12,962	2,150	24,063	1,018	25,081
Rochdale	* Mar. 31, 1912	May, 1902	,,	(i) 40	2	356,991	347,782	9,209	351,831	15,347	347,782	71,729	...	72,649	353	73,002
Rotherham ...	* Mar. 31, 1912	Jan., 1903	,,	12	0	228,550	155,000	73,550	154,589	12,882	132,835	46,413	18,123	35,724	133	35,857
Salford	* Mar. 31, 1912	Oct., 1901	,,	75	0	1,050,666	723,669	326,997	723,324	9,644	581,149	237,090	48,964	253,962	70	254,032
Southampton ...	* Mar. 31, 1912	Jan., 1900	,,	17	62	277,259	239,715	37,544	247,977	13,951	169,010	70,726	18,497	63,849	2,260	65,109
Southend-on-Sea	* Mar. 31, 1912	July, 1901	,,	11	49	130,000	129,961	39	143,808	12,384	116,940	12,784	3,045	34,453	465	34,918
Southport ..	Mar. 31, 1909	July, 1900	,,	10	61	292,000	197,200	94,800	195,967	10,314	144,240	52,960	9,001	19,218	341	19,559
South Shields ...	* Mar. 31, 1912	Mar., 1906	,,	10	21	251,882	174,935	76,947	172,322	16,791	156,111	26,920	15,864	32,160	772	32,932
Staly'ge, H., M., D.	* Mar 31, 1912	May, 1904	,,	27	57	325,270	273,470	45,800	279,778	10,096	230,488	48,982	173	39,198	365	39,563
Stockport ...	* Mar. 31, 1912	Aug., 1902	,,	27	50	305,028	234,500	70,528	238,199	8,623	176,002	58,498	54,219	59,594	1,245	60,839
Sunderland ...	* Mar. 31, 1912	Aug., 1900	,,	20	35	308,676	303,211	5,465	304,882	14,982	192,752	101,576	29,112	67,871	363	68,234
Wallasey ...	* Mar. 31, 1912	Mar., 1902	,,	19	69	192,546	191,249	1,297	210,671	10,606	167,586	53,395	10,544	57,337	770	58,107
Walsall	Dec. 31, 1911	Dec., 1902	,,	17	39	188,145	188,100	45	178,686	10,218	159,595	51,230	28,381	29,534	773	30,307
Walthamstow ...	* Mar. 31, 1912	June, 1905	,,	12	42	180,000	180,000	Nil	173,081	13,846	163,679	16,321	2,757	38,249	741	38,990
Warrington ...	* Mar. 31, 1912	April, 1902	,,	9	52	103,674	102,896	778	102,128	10,583	77,094	25,802	10,000	21,338	335	21,673
West Ham ...	* Mar. 31, 1912	Feb., 1904	,,	27	62	563,412	551,463	11,949	553,275	19,919	553,441	77,711	41,944	143,087	1,060	144,147
Wigan	* Mar. 31, 1912	April, 1901	,,	(k) 34	2	492,158	481,022	11,136	472,654	13,891	405,638	115,240	...	66,329	1,241	67,570
Wolverhampton	* Mar. 31, 1912	April, 1902	S.	21	40	279,733	265,616	14,117	277,510	12,908	223,496	55,578	45,891	51,452	807	52,259
Yarmouth (Gt.) ...	* Mar. 31, 1912	June, 1902	E.	14	32	144,500	119,750	24,750	121,322	8,425	112,550	19,623	5,739	24,380	520	24,900

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast	* Mar. 31, 1912	Nov., 1905	E.	81	25	1,556,272	1,131,200	425,072	1,125,864	14,041	1,093,000	152,675	89,406	239,263	3,805	243,068
Bexley	* Mar. 31, 1912	Oct., 1903	,,	6	42	99,942	96,984	2,958	96,924	14,854	78,800	18,184	(j) 1,074	13,826	1,542	15,368
Birkenhead ...	* Mar. 31, 1912	Feb., 1901	,,	24	7	371,474	364,854	6,620	366,708	15,222	259,103	105,724	15,076	59,282	4,369	63,651
Bournemouth ...	* Mar. 31, 1912	July, 1902	,,	(e) 29	62	449,027	434,462	14,565	438,194	19,601	341,688	113,617	5,656	91,422	233	91,655
Cardiff	* Mar. 31, 1912	May, 1902	,,	31	66	813,923	787,292	26,631	783,051	24,683	583,869	203,422	86,411	125,743	19,181	144,924
Glasgow	* May 31, 1912	Oct., 1898	,,	185	35	3,451,487	3,503,174	(g) 51,687	3,532,736	19,051	2,546,923	956,251	1,921,361	987,280	3,795	991,075
				(b) 11	29											
Huddersfield ...	* Mar. 31, 1912	Feb., 1901	,,	46	0	646,284	398,942	247,342	416,528	9,055	261,716	146,610	13,253	101,482	3,120	104,602
Hull	* Mar. 31, 1912	July, 1899	,,	29	43	669,273	510,805	158,468	511,273	17,309	505,511	133,787	133,028	151,164	1,622	152,786
Leeds	* Mar. 31, 1912	Aug., 1897	,,	112	62	1,588,406	1,531,789	56,617	1,490,162	13,805	1,232,742	432,775	4,487	391,142	4,179	395,321
Leicester	* Dec. 31, 1912	May, 1904	,,	37	0	739,240	719,223	20,017	722,021	19,514	607,476	129,211	100,000	134,966	12,705	147,671
London	* Mar. 31, 1912	...	H.	23	30	(c)	(c)	(c)	...	...	...	...	...	60,357	1,335	61,692
		May, 1903	C.E	255	60				11,850,127	...	11,309,789	2,423,040	920,402	2,231,902	62,587	2,294,489
N'castle-on-Tyne	* Mar. 31, 1912	Dec., 1901	E.	60	20	1,520,425	1,199,962	320,463	1,176,339	19,574	932,552	342,271	104,670	216,590	10,044	226,634
Northampton ...	* Mar. 31, 1912	July, 1904	,,	9	13	128,300	127,255	1,045	134,122	14,638	95,488	31,766	10,360	26,784	701	27,485
Portsmouth ..	* Mar. 31, 1912	Sep., 1901	,,	30	66	640,011	682,319	...	696,792	22,599	471,739	210,580	85,307	110,792	1,810	112,602
Preston	* Mar. 31, 1912	June, 1904	,,	17	16	224,101	187,269	36,832	187,269	10,888	129,765	37,200	31,466	40,355	292	40,647
Reading	* Mar. 31, 1912	July, 1903	,,	13	14	235,000	232,000	3,000	227,430	17,262	174,040	51,582	14,651	33,151	1,119	34,270
Sheffield	* Mar 25, 1912	Sep., 1899	,,	76	58	1,465,674	1,374,390	91,284	1,375,381	18,163	1,071,665	378,280	25,917	337,801	3,203	341,004
Wellington, N.Z.	* Mar. 31, 1912	...	,,	30	7	538,523	538,523	Nil	603,798	20,189	538,523	36,008	87,561	138,229	481	138,710

C = Electric conduit system. E = Electric trolley system. H = Horse lines. S = Surface contact system. (a) Accident insurance fund. (b) Lines leased and worked. (c) Conferred by Annual Money Act, which limits amount for each financial year Powers not exercised are lapsed. (e) Includes 7 mi. 34·53 chs. single track lines leased. (g) Borrowing powers exercised in excess. (h) Includes 1½ miles railless trolley route. (i) 17 mi. 8 chn. single track leased. (j) Including £574 accident insurance fund. (k) Not including 10 miles 3 chains single track lines leased. * Figures are inserted for the financial year 1911-12.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Working Expenses.					Gross Profit on Working.	Additions to Gross Profit.	Deductions from Gross Profit.						Net Surplus + or Deficit −
	Traffic.	General.	Repairs & Maintenance.	Power.	Total.			Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal.	Sundries.	Total.	
Aberdeen	19,738	8,682	5,740	6,803	40,969	36,211	365	7,561	4,519	...	19,886	214	32,180	+ 4,396
Accrington	7,594	2,124	1,851	4,235	15,794	10,427	...	4,132	3,599	49	...	...	7,780	+ 2,646
Ashton-und'r-Lyne	4,699	1,715	2,358	3,225	11,997	9,894	...	2,814	3,536	440	750	†1,004	8,544	+ 1,350
Ayr	3,403	1,959	1,383	1,925	8,670	7,082	...	2,100	1,669	132	1,966	128	5,995	+ 1,249
Birmingham ...	108,702	37,152	46,058	75,645	267,557	172,543	3,774	50,014	29,270	...	...	986	80,270	+ 96,047
Blackburn	14,542	4,755	11,296	10,643	41,236	21,894	...	(h) 5,954	14,650	...	1,000	...	21,604	+ 290
Blackpool	14,325	4,758	12,889	8,262	40,234	25,106	...	(h) 8,721	6,332	...	5,053	...	20,106	+ 5,000
Bolton	28,768	8,846	17,683	20,483	75,780	56,366	1,492	(h) 13,051	16,904	..	16,659	146	46,760	+ 11,098
Bradford	76,831	22,521	36,739	44,044	180,135	109,200	3,279	20,965	31,144	2,894	30,783	4,693	90,479	+ 22,000
Brighton	13,723	4,333	14,127	8,878	41,061	12,967	137	7,897	5,043	...	137	...	13,077	+ 27
Burnley	16,918	6,395	7,474	14,738	45,525	27,184	...	5,786	6,327	911	...	(f) 2,394	15,418	+ 11,766
Burton-on-Trent...	4,845	3,039	616	3,295	11,795	4,371	...	1,423	1,378	...	500	773	4,074	+ 297
Bury	14,731	4,778	7,121	8,132	34,762	31,452	183	7,462	5,495	112	...	(w) 10,578	23,647	+ 7,990
Chester	3,278	1,598	828	2,248	7,952	4,868	95	(h) 2,773	1,018	...	1,172	...	4,963	...
Chesterfield ...	2,712	1,166	1,469	2,019	7,366	4,839	219	2,426	1,799	...	...	...	4,225	+ 833
Colchester	2,771	1,134	1,584	2,486	7,975	2,759	56	(h) 2,273	2,235	...	...	...	4,508	− 1,693
Croydon	27,695	6,641	11,400	15,914	61,650	32,780	807	8,046	7,428	809	...	...	16,283	+ 17,304
Darlington	4,029	705	1,790	1,985	8,059	3,365	105	2,097	1,967	108	316	...	4,488	− 1,018
Darwen	3,448	754	2,627	2,232	9,061	5,710	111	2,314	2,186	...	1,050	...	5,550	+ 271
Derby	E 16,132 H 558	2,434 ...	4,428 55	9,026 ...	32,020 613	15,343 def. 188	266	6,944	3,274	...	...	(t) 208	10,426	+ 5,183
Doncaster	4,071	940	4,325	3,918	13,254	4,415	186	2,744	1,309	...	107	441	4,601	...
Dundee	16,160	4,963	7,262	10,999	39,384	23,296	...	8,635	5,950	217	6,902	546	22,250	+ 1,046
East Ham	16,218	6,024	10,014	9,415	41,671	16,339	...	(h) 5,846	6,555	...	517	85	13,003	+ 3,336
Exeter	4,571	1,429	1,231	3,643	10,874	6,416	...	2,384	1,749	16	...	...	4,149	+ 2,267
Gloucester	6,346	1,593	2,358	1,991	12,288	4,714	...	4,813	2,218	...	...	...	7,031	− 2,317
Halifax	25,150	6,073	14,705	16,962	62,890	39,003	...	10,381	10,196	...	13,214	405	34,196	+ 4,807
Ilford	8,930	2,010	4,838	4,664	20,442	9,124	557	4,315	4,725	...	641	...	9,681	...
Ilkeston	2,359	579	1,613	1,476	6,027	662	157	1,578	1,644	..	...	210	3,432	− 2,613
Ipswich	7,839	1,613	3,585	3,824	16,861	6,078	...	3,691	2,024	...	117	69	5,901	+ 176
Keighley	2,769	724	940	1,551	5,984	3,855	224	1,160	1,815	...	...	(n) 1,104	4,079	...
Kilmarnock ...	3,271	774	988	1,754	6,787	1,850	7	(h) 1,637	1,238	2	1,160	...	4,037	− 2,180
Kirkcaldy	4,741	1,474	1,324	2,436	9,975	6,090	...	2,695	1,551	...	409	111	4,766	+ 1,324
Lancaster	2,289	506	916	1,694	5,404	306	92	1,352	1,425	...	...	...	2,777	− 2,379
Leith	9,057	2,439	3,588	3,147	18,231	16,452	86	(h) 6,566	7,750	...	...	139	14,455	+ 2,093
Leyton	(p) 16,573	5,056	8,211	11,672	41,512	21,156	...	10,340	7,596	...	1,478	264	19,678	+ 1,478
Lincoln	1,487	615	1,054	926	4,082	2,732	8	1,529	1,071	...	...	...	2,600	+ 140
Liverpool	167,045	58,771	80,184	113,893	419,893	224,281	24,045	50,096	59,155	...	(d) 66,929	(e) 5,217	181,397	+ 66,929
Lowestoft	3,240	838	2,432	3,020	9,530	2,443	..	(h) 2,270	1,513	...	...	...	3,784	− 1,340
Maidstone	2,324	1,077	1,139	1,868	6,408	3,389	58	(h) 2,797	2,185	...	...	74	5,056	− 1,609
Manchester ...	240,016	81,312	81,353	127,388	530,069	326,720	13,963	56,724	50,856	7,413	110,604	30,086	255,683	+ 85,000
Nelson	2,241	587	1,689	1,965	6,482	2,930	...	993	938	...	...	...	1,931	+ 999
Newport (Mon.) ...	9,900	3,230	5,882	7,516	26,528	10,654	904	6,145	4,074	...	...	...	10,219	+ 1,339
Nottingham ...	41,707	14,419	17,775	32,261	106,162	56,436	...	14,970	19,303	...	...	...	34,273	+ 22,163
Oldham	25,086	6,931	17,077	22,090	71,184	30,915	1,369	15,448	11,501	1,636	...	(k) 6,112	34,697	− 2,413
Perth...	3,795	680	450	1,347	6,272	3,829	45	2,332	2,006	2	640	51	5,031	− 1,157
Plymouth	7,933	3,542	5,029	7,577	24,081	13,832	1,258	4,778	3,931	...	3,354	...	12,063	+ 3,027
Pontypridd ...	5,307	1,469	6,611	3,656	17,043	6,123	5	(h) 4,293	4,034	...	590	41	8,958	− 2,830
Rawtenstall ...	5,292	2,216	2,049	3,958	13,515	11,566	(q) 1,663	6,148	5,531	...	...	...	11,679	+ 1,550
Rochdale	16,421	4,475	6,944	9,527	37,367	35,635	246	11,380	9,594	694	...	(z) 7,727	29,395	+ 6,486
Rotherham... ...	8,991	2,539	5,187	8,497	25,214	10,643	944	4,393	2,757	...	3,707	...	10,837	+ 750
Salford	67,947	16,384	24,721	47,166	156,218	97,814	5,158	19,550	23,846	2,295	9,569	(k) 29,712	84,972	+ 18,000
Southampton ...	17,703	4,879	8,782	12,454	43,818	22,291	6,099	6,779	6,578	574	...	488	14,419	+ 13,971
Southend-on-Sea	8,046	2,260	3,534	6,187	20,027	14,891	4,228	(h) 3,835	1,753	...	4,017	...	9,605	+ 9,514
Southport	4,754	2,016	1,963	3,357	12,090	7,469	6,421	6,422	4,966	...	1,997	40	13,425	+ 465
South Shields ...	7,642	3,002	2,471	5,311	18,426	14,506	274	(h) 5,615	3,501	...	...	...	9,116	+ 5,664
Staly'dge, H., M., D.	13,716	4,839	5,669	6,079	30,303	9,260	...	(h) 7,948	7,095	...	173	516	15,732	− 6,472
Stockport	12,436	3,717	6,437	4,781	27,371	33,468	1,326	5,978	8,363	910	6,795	3,208	25,254	+ 9,540
Sunderland ...	18,517	5,181	4,503	10,754	38,955	29,279	408	(h) 7,263	9,880	271	6,818	455	24,687	+ 5,000
Wallasey	16,074	4,027	5,281	12,979	38,361	19,746	474	6,270	4,383	...	2,500	633	13,786	+ 6,434
Walsall	6,595	2,721	3,923	4,569	17,808	12,499	1,395	5,353	3,462	399	...	(v) 3,104	12,318	+ 1,576
Walthamstow ...	13,413	2,547	5,204	7,423	28,587	10,403	210	(h) 6,214	2,599	...	...	...	8,813	+ 1,800
Warrington ...	5,318	1,547	3,252	3,315	13,432	8,241	63	2,689	3,159	...	...	...	5,848	+ 2,456
West Ham	49,252	12,386	20,005	22,055	103,698	36,417	979	20,154	12,289	444	426	...	33,313	+ 4,083
Wigan	15,468	5,227	9,664	10,837	41,196	26,374	95	(h) 14,575	12,269	...	...	3,714	30,558	+ 4,088
Wolverhampton ...	12,184	3,891	7,273	6,300	29,648	22,611	(x) 890	7,924	4,990	200	3,882	9	17,005	+ 6,496
Yarmouth (Gt.) ...	7,482	1,835	2,968	4,031	16,316	8,584	110	(h) 4,014	2,699	...	1,250	113	8,076	+ 618

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast	68,080	12,678	28,395	20,190	129,343	113,725	750	39,647	24,554	1,082	13,000	3,359	81,642	+ 32,833
Bexley	(a) 5,465	984	1,892	920	9,261	6,107	...	2,942	2,325	...	500	...	5,767	+ 340
Birkenhead ...	15,706	4,055	10,609	9,232	39,602	24,049	...	11,626	9,502	143	2,479	299	24,049	...
Bournemouth ...	22,385	7,624	11,045	13,787	54,841	36,814	838	10,852	15,521	...	...	(e) 7,900	34,273	+ 3,379
Cardiff	37,145	(c) 10,512	14,894	17,223	79,774	65,150	1,529	24,327	23,079	750	6,947	...	55,103	+ 11,576
Glasgow	295,525	116,405	125,844	44,866	582,640	408,435	49,772	75,092	93,864	13,028	213,704	10,452	406,140	+ 52,067
Huddersfield ...	24,351	5,803	17,989	9,036	57,239	47,363	6,458	(h) 11,522	10,139	1,426	17,780	15	40,882	+ 12,939
Hull	43,701	12,183	31,384	10,676	97,944	54,842	1,193	15,236	11,335	1,433	...	(a) 6,920	34,924	+ 21,111
Leeds	103,155	31,210	38,235	24,914	197,514	197,807	6,270	42,613	52,931	4,879	37,314	(y) 5,176	142,913	+ 61,164
Leicester	47,876	9,497	22,023	15,633	95,029	52,642	2,512	23,252	12,095	1,939	7,668	...	44,954	+ 10,000
London	H 28,811 E 696,620	4,371 (r) 188,382	7,782 295,669	(m) 32,694 167,639	73,658 1,348,310	def. 11,966 946,179	... 29,440	334,173	369,356	22,858	138,152	(l) 26,529	891,068	+ 84,581
N'castle-on-Tyne...	60,663	17,730	29,951	(g) 13,668	122,012	104,622	3,598	30,972	39,314	2,697	8,427	(j) 13,368	94,778	+ 13,442
Northampton ...	6,774	1,886	2,237	3,496	14,393	13,092	845	(h) 3,637	4,206	244	1,776	(b) 874	10,737	+ 3,200
Portsmouth ...	28,392	9,780	9,225	4,482	51,879	60,723	2,677	20,798	17,458	1,109	8,694	1,273	49,332	+ 14,068
Preston	10,630	5,144	5,847	2,351	23,972	16,675	...	4,324	4,749	...	...	1,361	10,434	+ 6,241
Reading	8,518	3,545	4,307	3,246	19,616	14,654	...	6,626	4,662	162	...	...	11,450	+ 3,204
Sheffield	108,738	25,139	38,542	24,188	196,607	144,397	3,129	40,960	41,527	3,705	25,411	2	111,605	+ 35,921
Wellington, N.Z....	53,887	7,505	23,067	15,451	99,910	38,800	978	20,320	4,794	...	17,489	...	42,603	− 2,825

(a) Includes £4,393 loss on motor omnibuses. (b) Includes £537 loss on omnibus account. (c) Includes £1,570 insurance fund. (d) Includes reserve.
(e) Rents for leased lines. (f) £2,061 rent of leased lines. (g) Including street lighting. (h) Including income tax. (t) Accrued interest.
(j) Including £12,250 commuted payment to Newcastle Electric Supply Company. (k) Includes rents of lines. (l) Including loss on horse traction.
(m) Horsing expenses. (n) Transferred to motor omnibus capital account. (o) Including £9,612 for lighting generation. (p) Includes £243 horse account.
(q) Aid from rates £1,500. (r) Including special charges, £17,478. (s) Including £2,128 through-running expenses.
(v) Includes £2,221 purchase of St. Paul's Buildings. (w) Amount apportioned to leased lines. (x) Includes £191 profit on motor char-a-banc.
(y) Includes rent of Morley Light Railway, rotary converter, and new brakes. (z) Includes £4,386 rent of leased lines.
This item includes £734 payable to Sinking Fund of Hurst U.D.C.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Appropriation of Net Surplus.			Receipts per Car Mile.		Operating Expenses per Car Mile.					Percentage of Operating Expenses to Total Revenue.	Average Operating Expenses per Car Mile (excludi'g Power Cost).	Board of Trade Units.		
	Carried Forward.	Reserve.	Contribution to Rates or Municip'l Funds.	Average Total per Car Mile. d.	Average Traffic per Car Mile. d.	Traffic. d.	General. d.	Repairs and Maintenance. d.	Power. (Price paid) d.	Total. d.	%	d.	Units.	Cost per Unit. d.	Units used per car mile.
Aberdeen ...	..	4,396	...	11·27	11·12	2·888	1·268	·870	·994	5·98	53·08	4·986	1,893,077	·86	1·152
Accrington ...	...	2,489	...	12·05	11·84	3·49	·86	·96	1·95	7·126	60·23	5·31	1,075,437	1·20	1·60
Ashton-u-Lyne	...	...	1,350	11·475	11·186	2·463	·899	1·236	1·691	6·289	54·801	4·598	619,289	1·25	1·353
Ayr...	...	...	1,249	9·79	9·38	2·11	1·21	·86	1·19	5·39	55	4·19	374,296	1·24	·97
Birmingham ...	...	50,000	46,047	11·199	11·045	2·996	·887	1·099	1·925	6·907	60·7	4·982	14,191,012	1·2432	1·51
Blackburn ...	290	...	...	13·47	12·86	3·10	1·02	2·41	2·27	8·80	65·31	6·53	1,949,566	1·3	1·81
Blackpool ...	...	...	5,000	16·63	16·37	3·65	1·21	3·28	2·10	10·24	61·57	8·14	1,238,641	1·60	1·31
Bolton	598	...	10,500	11·364	11·279	2·474	·761	1·521	1·761	6·517	57·778	4·752	4,468,961	1·1	1·601
Bradford	...	...	22,000	12·211	11·600	3·398	·700	1·320	1·545	6·963	62·259	5·418	10,574,643	1	1·830
Brighton	27	...	...	11·384	10·987	2·891	·914	2·976	1·871	8·652	76	6·781	1,775,559	1·2	1·56
Burnley	...	4,466	7,300	12·610	12·566	2·934	1·109	1·296	2·556	7·895	62·74	5·32	2,855,006	1·24	2·05
Burton-on-Trent	297	...	...	8·80	8·07	2·64	1·65	·33	1·80	6·42	77·75	4·88	572,569	1·38	1·13
Bury	...	3,576	4,414	10·02	10·00	2·228	·743	1·239	1·326	5·536	52·50	4·210	2,085,636	1·070	1·329
Chester	...	...	...	8·84	8·51	2·26	1·10	·57	1·55	5·48	62	3·93	397,691	·764	1·14
Chesterfield ...	...	833	...	10·10	9·69	2·24	·96	1·22	1·68	6·1	59·6	4·43	387,704	1·25	1·3
Colchester ...	...	...	...	7·959	7·625	2·055	·84	1·174	1·844	5·913	73·95	4·069	397,795	1·50	1·23
Croydon	...	9,304	8,000	9·234	9·049	2·791	·671	1·139	1·556	6·157	64·73	4·474	2,287,566	1·554	·929
Darlington ...	...	...	...	7·488	7·246	2·540	·444	1·129	1·252	5·365	71·66	4·113	476,444	1	1·252
Darwen	271	...	...	14·18	13·9	3·645	·708	2·224	2·507	9·084	61·3	6·55	421,503	1·313	1·68
Derby	5,183	...	...	E 9·79 H. 5·70	9·50 5·47	3·33 7·49	·50 ...	·92 ·74	1·87 ...	6·62 8·23	67·60 144·21	4·75 ..	1,480,150 ...	1·50&1·45 ...	1·274 ...
Doncaster ...	...	...	...	8·49	8·29	1·94	·44	2·06	1·86	6·30	75·1	4·44	683,855	1·375	1·35
Dundee	...	46	1,000	11·263	10·980	2·904	·891	1·306	1·976	7·077	61·9	5·10	2,356,993	1·125	1·764
East Ham ...	.	...	...	10·39	10·26	2·90	1·08	1·79	1·69	7·46	71·8	5·77	1,995,635	1·125	1·49
Exeter	...	2,267	...	9·653	9·653	2·552	·798	·687	2·034	6·071	62·89	4·037	537,997	1·625	1·251
Gloucester ...	...	...	...	6·694	6·258	2·498	·627	·929	·784	4·838	72	4·054	472,359	1	·77
Halifax	...	...	4,807	11·630	11·515	2·871	·693	1·678	1·936	7·178	62	5·242	3,563,953	1·125	1·69
Ilford	...	...	...	9·356	9·186	2·826	·636	1·531	1·476	6·469	69·2	4·993	994,999	1·125	1·31
Ilkeston	...	...	...	6·73	6·57	2·36	·58	1·63	1·49	6·06	90·25	4·57	339,920	1·042	1·4
Ipswich	176	...	...	8·306	8·096	2·838	·584	1·299	1·384	6·105	73·50	4·721	667,441	1·375	1·007
Keighley	...	...	...	9·721	9·473	2·736	·715	·929	1·532	5·912	61	4·380	248,096	1·5	1·021
Kilmarnock ...	...	...	...	6·709	6·525	2·541	·601	·769	1·362	5·273	78·6	3·911	336,801	1·25	1·09
Kirkcaldy ...	1,324	...	...	8·152	7·908	2·406	·748	·672	1·236	5·062	64	3·82	668,134	·875	1·413
Lancaster ...	...	...	...	7·55	7·87	3·105	·681	1·246	2·298	7·33	93	5·03	239,119	1·7	1·35
Leith	2,093	...	...	8·72	8·51	2·28	·61	·91	·78	4·58	52·54	3·8	863,202	·875	·9
Leyton	1,478	...	...	10·365	10·142	(c) 3·143	·964	1·417	1·711	7·235	66·241	5·524	2,542,672	1·078	1·587
Lincoln	140	...	...	10·12	9·92	2·20	·92	1·56	1·37	6·05	59·8	4·68	184,710	1·25	1·098
Liverpool ...	...	...	66,929	12·03	12·28	3·184	1·120	1·529	2·171	8·004	63·6	5·833	...	...	...
Lowestoft ...	...	...	...	8·6	8·4	2·3	·6	1·7	2·1	6·8	79·59	4·7	414,094	1·75	1·2
Maidstone ..	...	...	...	8·19	7·77	1·942	·900	·952	1·55	5·344	69	3·79	358,616	1·25	1·25
Manchester ..	...	...	85,000	11·375	11·225	3·187	1·079	1·080	1·691	7·037	61·87	5·346	29,890,427	1·023	1·653
Nelson	999	...	...	11·38	11·34	2·71	·71	2·04	2·38	7·84	69	5·46	235,288	2	1·19
Newport (Mon.)...	...	(h) 1,339	...	9·678	9·464	2·577	·840	1·532	1·956	6·905	71·40	4·949	1,389,504	1·25	1·51
Nottingham ...	...	4,163	18,000	11·22	11·06	2·34	1·56	1·20	2·22	7·32	65·29	5·10	6,039,203	1·25	1·73
Oldham	...	..	...	12·616	12·515	3·100	·857	2·110	2·729	8·796	69·72	6·067	3,541,360	1·375	1·823
Perth	...	...	...	8·88	8·46	3·59	·64	·43	1·27	5·93	59	4·04	289,473	1·083	1·17
Plymouth ..	...	...	3,027	11·253	11·007	2·346	1·041	1·488	2·247	7·122	63·52	4·875	1,087,297	1·672	1·34
Pontypridd ...	...	...	...	10·92	10·78	2·71	·75	3·37	1·87	8·70	80·65	6·83	701,941	1·25	1·49
Rawtenstall ...	...	1,550	...	11·16	10·71	2·35	·98	·92	1·76	6·01	53·54	4·25	687,821	1·381	1·27
Rochdale	6,486	...	...	11·020	10·966	2·479	·691	1·067	1·533	5·770	51·2	4·237	2,250,037	1·016	1·508
Rotherham ...	...	...	750	11·950	11·906	2·996	·846	1·729	2·832	8·403	70·32	5·571	1,359,602	1·5	1·88
Salford	...	...	18,000	10·497	10·494	2·807	·677	1·022	1·949	6·455	62	4·506	9,137,678	1·238	1·58
Southampton ...	8,971	...	5,000	10·672	10·307	2·857	·788	1·418	2·010	7·073	66·3	5·063	1,874,217	1·625	1·266
Southend-on-Sea	2,514	1,000	6,000	13·14	12·97	3·03	·85	1·33	2·33	7·54	57·35	5·21	848,538	1·75	1·33
Southport ...	...	...	...	10·294	10·115	2·502	1·06	1·033	1·767	6·363	61·8	4·596	522,972	1·5	1·182
South Shields ...	(d) 500	5,164	...	9·710	9·483	2·253	·885	·729	1·566	5·433	55·95	3·867	904,332	1·4094	1·111
Stalybridge, &c.	...	...	...	7·640	7·569	2·649	·934	1·095	1·174	5·852	76·34	4·678	1,947,561	·75	1·567
Stockport .		540	9,000	10·434	10·221	2·133	·638	1·103	·820	4·694	44·99	3·874	1,704,943	1·036	1·218
Sunderland ...	...	...	5,000	10·917	10·859	2·962	·829	·721	1·721	6·233	56·32	4·512	1,720,607	1·5	1·14
Wallasey ...	234	(f) 200	6,000	11·357	11·207	3·142	(g) ·787	1·032	2·563	7·497	65	4·96	1,916,450	1·625	1·56
Walsall	1,576	...	...	11·042	10·760	2·403	·991	1·429	1·665	6·488	58·759	4·823	757,973	1·5	1·151
Walthamstow ..	1,800	...	...	9·31	9·13	3·20	·61	1·24	1·77	6·82	73·32	5·05	1,188,326	1·5	1·18
Warrington ...	338	618	1,500	11·727	11·545	2·877	·837	1·760	1·794	7·268	61·796	5·474	530,436	1·5	1·196
West Ham ...	...	4,083	...	10·44	10·33	3·659	·904	1·461	1·609	7·633	72	6·024	5,571,743	·95	1·69
Wigan	...	...	...	11·206	11·007	2·565	·866	1·603	1·798	6·832	60·97	5·03	2,190,122	1·187	1·52
Wolverhampton	...	2,719	3,777	10·967	10·798	2·557	·817	1·526	1·322	6·222	56·73	4·90	1,508,410	1	1·319
Yarmouth (Gt.)...	618	...	...	8·962	8·775	2·695	·660	1·067	1·450	5·872	66·92	4·422	643,282	1·50	·964

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

									*					Works Cost.	
Belfast	...	...	32,833	10·29	10·12	2·88	·54	1·20	·85	5·47	53·21	4·62	7,734,501	·626	1·36
Bexley	40	..	...	12·8	12·63	3·04	·89	1·75	·87	6·55	60·3	5·68	350,103	·63	1·37
Birkenhead ...	...	...	...	11·77	11·609	3·075	·793	2·076	1·166	7·110	60·37	5·98	2,454,214	·561	2·002
Bournemouth ..	...	3,379	...	11·92	11·89	2·91	·99	1·44	(b) 1·79	7·13	59·83	5·34	2,743,998	·576	1·48
Cardiff	6,926	...	4,650	13·45	11·65	3·446	·976	1·382	·634	6·438	55	5·804	3,864,260	·415	1·49
Glasgow	...	...	52,067	10·602	10·561	3·162	1·245	1·346	·480	6·233	55·98	5·753	30,261,134	·355	1·35
Huddersfield ...	6,481	...	6,458	11·18	10·85	2·60	·62	1·93	·97	6·12	54·72	5·15	5,120,215	·65	2·22
Hull	...	9,111	12,000	9·75	9·65	2·81	·78	2·00	·68	6·27	63·72	5·47	4,728,903	·55	1·26
Leeds	...	...	61,164	11·125	11·008	2·903	·878	1·076	·700	5·557	49·96	4·857	15,716,216	·380	1·778
Leicester	...	...	10,000	9·675	8·843	3·137	·622	1·443	1·024	6·226	64	5·202	6,558,800	·3645	1·79
London	...	84,551	...	8·81 11·29	8·62 10·98	4·12 3·42	·62 ·93	1·11 1·45	4·67 ·83	10·52 6·63	119·40 58·76	10·52 5·80	... 122,307,298	... ·61	... 2·51
N'castle-on-Tyne	...	...	13,442	11·841	11·317	3·170	·926	1·565	(a) ·714	6·375	52·23	5·661	8,745,068	·356	1·904
Northampton ...	...	1,200	2,000	10·11	9·85	2·51	·67	·82	1·29	5·29	52	4·00	1,032,199	·81	1·88
Portsmouth ...	8,068	(f) 2,000	4,000	12·261	12·069	3·092	1·065	1·004	·488	5·649	46·08	5·161	2,583,580	·448	1·041
Preston	...	6,241	...	10·415	10·34	2·724	1·319	1·499	·602	6·144	59·22	5·542	1,377,176	·409	1·236
Reading	...	1,344	1,860	8·968	8·676	2·229	·928	1·127	·849	5·133	57	4·28	955,400	·815	·90
Sheffield	...	2,000	33,921	10·601	10·501	3·380	·782	1·198	·752	6·112	57·655	5·360	15,603,810	·642	1·784
Wellington, N.Z.	...	...	...	14·615	14·666	5·698	·793	2·439	1·634	10·564	72·03	8·93	4,873,707	·765	2·14

H—Horse lines. E.—Electric trolley system. * The figures given under "Power" in Table II. include actual works costs only. (a) Including power and street lighting. (b) Including ·98d. per car mile current supplied by Bournemouth and Poole Supply Company. (c) Horse account ·054d. (d) Accident, insurance, and compensation fund. (e) Total B.O.T. units, including lighting, 10,215,925. (f) Insurance fund. (g) Including ·09d. to Superannuation Fund. (h) Renewals Fund.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Population Served.	Car Mileage.	Passengers Carried.	Traffic Records. Passengers Carried per Car Mile.	Average Fare per Passenger. d.	Average Journeys per Head of Populat'n per Annum.	Average Car Miles per Day per Car.	Traffic Revenue per Mile of Single Track. £	Average Traffic Revenue per Annum per Head of Populat'n Served.	Operating Expenses per Passenger. d.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Average Speed per Hour. Miles.	Average Total Car Hours per Day.	Average Number of Cars in Use Daily.	Number of Cars in Stock.
Aberdeen ...	165,000	1,643,247	19,054,847	11·59	·96	121·5	99·7	2,744	9·3	·516	1·7	·6	7·5	640	45	71
Accrington ...	45,075	671,374	4,336,545	8·5	1·42	96·2	105	2,406	11·5	·874	1·07	·929	7·5	242	17	27
Ashton-u-L.	50,000	457,856	4,754,139	10·383	1·077	95·083	104	2,606	8/6	·606	1·223	·81	8	204	12	21
Ayr	33,000	385,796	3,739,237	9·69	·96	113	106	1,981	9·2	·556	1·25	·75	8	14	10	20
Birmingham	570,113	9,431,282	113,475,399	12·03	·9	199·04	84·53	4,278	15/3	·79	2·600	·391	7·5	10·91	330	360
Blackburn ...	200,000	1,125,036	11,164,915	10·53	1·27	55·82	105	2,432	6	·886	1·25	·76	7·50	434	31	61
Blackpool ...	67,000	942,829	10,339,719	11	1·36	154·4	83	3,705	19·2	·934	...	...	8	...	31	72
Bolton ...	221,000	2,792,236	29,319,812	10·50	1·073	132·669	120·66	2,790	11·10	·654	1·468	·627	7·25	1,030	60	106
Bradford ...	337,000	5,686,653	56,352,281	9·91	1·168	167	113·72	2,717	16·3	·767	1·60	·514	7·3	2,123·5	137	239
Brighton ...	131,444	1,139,048	11,382,406	10	1·10	86·6	91·76	3,033	7·11	·865	1·27	·788	6·41	544	34	50
Burnley ..	170,000	1,383,822	14,468,231	10·46	1·19	85	100	3,450	8/6	·755	1·25	·83	7	764	36	57
Burton ...	48,000	440,941	3,300,252	7·48	1·078	69	...	1,734	6·9	·86	1·35	·69	7·5	...	...	20
Bury	128,202	1,586,536	14,606,564	9	1·08	113·93	110·74	1,915	10·4	·571	1·24	·85	8·61	505·45	39·71	50
Chester .	39,038	347,904	3,078,564	8·85	·96	2·34	95	1,944	6·4	·622	1·27	·8	7	150·6	10·04	18
Chesterfield	38,000	289,890	2,519,533	8·69	1·1	66	132	2,249	6·5	·702	1·38	·75	7·33	117	6·5	14
Colchester ...	43,452	323,693	1,828,878	5·65	1·34	41·85	89·2	1,295	4·9	1·04	·89	1·10	6·84	149·79	10·26	18
Croydon ..	167,918	2,462,468	20,849,230	8·494	1·065	124·16	118	4,838	11·4	·710	2·206	·49	7·88	843·92	56	75
Darlington ...	56,800	380,572	3,674,075	9·6	·751	64·68	94·5	1,295	4/	·556	1·098	·9	6·66	151·25	11	16
Darwen ...	40,611	249,950	2,785,037	11·1	1·17	68·5	40	2,029	7/2	·781	1·05	·78	8	115·56	6·42	17
Derby ...	124,544	E 1,161,398	10,604,977	9·13	1·05	85·15	...	2,103	7/5	·724	1·44	·75	6·375	...	...	50
		H. 17,876	98,364	5·44	·993			...	...	1·49	1	1	..	...	..	...
Doncaster ...	50,000	504,250	4,532,625	8·98	·922	90·65	115	1,479	7/-	·702	1·25	·76	7·5	221	14	25
Dundee ..	165,000	1,335,512	17,022,560	12·74	·861	103	87	2,222	7/7	·555	2	·50	7·3	555	42	66
East Ham ...	133,000	1,340,252	17,789,734	13·27	·77	134	...	3,981	8/7	·56	1·63	·65	...	...	...	45
Exeter ...	48,500	429,878	4,241,671	9·87	·977	87·5	81	2,470	7/2	·615	1	1	6	224	16	20
Gloucester ...	52,795	609,531	4,111,175	6·7	·92	77	92·5	1,059	6/	·70	1·5	·65	7·11	243	18	30
Halifax ...	176,000	2,102,757	18,749,456	8·92	1·26	107	77	1,859	11·6	·805	1·35	·84	6·8	803	73	95
Ilford ...	80,000	758,456	7,784,992	11·21	·84	97·31	130	2,560	6·10	·630	1·543	·69	8	...	16	26
Ilkeston ...	32,000	238,645	1,732,846	7·25	·9	54	117	1,713	6·1	·836	3·2	·35	7·5	108	7·5	13
Ipswich ...	74,500	662,792	5,526,496	8·33	·971	74·81	66·91	1,502	5/10	·732	1·53	·693	6·12	332·48	20·78	36
Keighley ...	42,000	242,919	2,245,120	9·242	·98	53·45	55·42	1,568	4·7	·639	2·22	·45	6·87	126	7	12
Kilmarnock	36,000	308,976	2,268,033	7·34	·88	63	90·34	1,508	4/8	·728	1·13	·86	7·22	116·5	9·37	14
Kirkcaldy ...	39,600	472,928	5,198,320	10·9	·719	131·2	52	1,771	7·11	·460	1·522	·75	7	169	16	22
Lancaster ...	41,414	176,903	1,473,987	8·33	·906	36	76	1,159	2·8	·88	1·71	·5	6	88·90	6·35	12
Leith ..	81,000	954,563	9,339,324	9·7	·87	115·30	123	1,880	8·4	·46	1·32	·72	8·2	320	21·33	37
Leyton ...	124,736	1,601,833	16,897,512	10·549	·873	135	104	3,324	9/10	·590	...	...	7·70	574·56	42	60
Lincoln ...	20,000	161,897	1,712,109	10·57	·93	85·6	64·7	2,255	6·8	·572	1·75	·428	7	90	5	8
Liverpool ...	...	12,590,408	134,249,967	10·66	1·128	...	...	5,303	...	·756	2·45	...	...	...	445	587
Lowestoft ...	37,000	334,473	2,644,845	8	1·05	71·48	75·8	2,125	6/4	·864	univ'rs'l penny fare		8	176	12	19
Maidstone ...	25,000	287,179	2,096,488	7·3	1·062	83·85	70	1,319	7/5	·73	1	1	6·7	128	12	19
Manchester	950,000	18,076,999	174,424,237	9·65	1·16	184	97·2	4,892	17/10	·729	2·293	·435	8·24	...	508	617
Nelson ...	45,000	198,414	2,509,514	12·65	·89	55·77	90·35	2,425	4/2	·619	1	1	5·50	108	6	9
Newport ...	85,634	922,064	8,937,257	9·69	·998	104·4	109	2,518	8/6	·488	1·4 68	·66	6·77	184	27	44
Nottingham	260,000	3,476,262	36,026,471	10·36	1·06	138	95·74	4,388	12/4	·70	1·68	·65	6·86	...	100	135
Oldham ...	180,000	1,942,147	20,073,483	10·335	1·19	111·51	106·5	2,796	11·3	·851	1·12	·884	6·56	800	50	92
Perth... ...	35,900	253,851	1,861,145	7·33	1·15	51·84	96·25	1,892	5·5	·72	...	...	6·25	120	8	12
Plymouth ...	112,000	809,036	8,666,269	10·71	1·026	77·377	93·5	...	6·8	·667	...	...	...	25·5	...	42
Pontypridd...	40,000	470,215	4,721,110	10·04	1·07	118	83·4	2,457	10/7	·77	1·25	·51	6·5	234	18	26
Rawtenstall	30,516	539,320	4,669,522	8·66	1·24	93·39	123	1,515	15/9	·69	1·12	·88	9	164	12	22
Rochdale ...	130,000	1,589,866	12,711,114	7·99	1·35	97·7	114·90	1,825	11/2	·76	1·07	·90	7·66	645	43	69
Rotherham...	64,000	720,133	7,813,922	10·85	1·097	122·1	116	2,977	11/2	·774	1·5	1	12	19	20	36
Salford ...	350,000	5,808,369	48,720,788	8·38	1·30	139	114	3,386	14·6	·76	1·85	·55	7·96	2,135	140	200
Southampt'n	122,200	1,486,746	12,348,658	8·306	1·241	101	...	3,592	10·5	·85	...	...	...	...	...	68
Southend ...	78,000	637,366	7,581,104	11·89	1·09	97·2	87	4,708	8/10	·634	1·41	·76	...	...	...	31
Southport ...	33,792	485,967	4,371,296	9·586	1·05	129·3	103·8	1,770	11/4	·66	1·6	·619	6·6	204	14·3	26
So'th Shields	108,649	813,947	8,032,488	9·868	·957	73·9	129·2	3,138	5/2	·555	1·825	·54	7·61	282	16	35
Stalybridge	92,585	1,242,777	10,256,918	8·253	·907	110·5	...	1,445	8·5	·709	1·275	·784	6·8	...	...	60
Stockport	120,000	1,399,314	10,665,098	7·6	1·341	88·8	76·6	2,158	9/11·3	·615	1·25	·72	7·5	465	38	50
Sunderland	170,000	1,500,015	16,783,776	11·1	·970	98·7	79·4	3,335	8/-	·550	1·34	·68	7	672	42	70
Wallasey ...	81,000	1,227,935	11,459,807	9·33	1·20	141·48	98·6	2,887	14·2	·803	1·99	·52	7	590	42	55
Walsall ...	100,000	658,712	5,420,066	8·228	1·308	54·2	106	1,689	5·11	·788	1·24	·77	7	315	21	32
Walth'mst'w	126,000	1,004,872	12,049,323	11·99	·762	95·63	97	3,052	6/1	·569	1·15	·89	7·2	408	36	38
Warrington	86,000	443,560	5,647,137	12·731	·907	65·664	102·15	2,251	4/11	·57	1·246	·803	6·384	189·84	11·865	21
West Ham ..	291,900	3,287,917	41,017,958	12·47	·827	140	92	5,089	9·10	·61	1·79	·57	7·33	1,255·5	93	118
Wigan ...	200,000	1,447,048	12,112,333	8·37	1·314	65·6	96	2,140	6·7	·816	1·47	·9	7·4	800	40	67
Wolverh'ton	135,000	1,143,542	11,253,196	9·84	1·09	83·36	87	2,393	7·7	·626	1·149	·923	6·85	612	36	49
Yarmouth ...	52,000	666,793	4,633,251	6·95	1·265	12·823	73·07	1,681	9/4·5	·845	1·25	·76	7	375	25	35

TABLE II.—TOWHS WITH SEPARATE GENERATING STATIOHS FOR TRACTION.

Belfast ...	385,492	5,671,776	54,546,856	9·62	1·05	141	128	3,107	12/5	·57	1·96	·43	8·75	1,776	(b) 224	250
Bexley ...	16,000	262,658	2,130,189	8·11	1·56	133	...	2,360	18/11	·95	1·37	·62	7·5	...	8	16
Birkenhead	130,832	1,225,544	13,273,858	10·83	1·072	101·46	68·96	2,461	9·1	·716	1·39	·70	6·61	494·48	48·55	59
Bournem'uth	120,000	1,844,507	15,121,935	8·09	1·45	126	84·23	3,069	15·3	·87	1·19	·87	6·80	820	60	81
Cardiff ...	182,729	2,586,421	27,561,652	10·66	1·09	151	98·5	3,947	13/9	·69	1·44	·736	7·5	1,104	69	130
Glasgow ..	1,150,000	22,435,076	275,610,385	12·285	·860	239·66	105·29	5,037	17·2	·507	2·31	·44	8·13	8,150·63	582·19	808
Huddersfield	150,000	(a) 2,245,427	20,471,968	9·15	1·13	136	118	3,487	13·7	·67	1·31	·71	7·41	828·96	51·81	86
Hull	282,987	3,761,809	41,277,202	10·97	·87	148·06	123·82	5,117	10·8	·564	2·75	·36	9	1,328·16	83·01	151
Leeds ...	500,000	8,527,957	86,021,943	10·08	1·089	172·04	113·29	3,530	16·7	·932	1·95	·539	7·45	3,135	209	236
Leicester ...	229,296	3,663,215	32,907,795	8·983	·981	143	95	3,648	11/9	·693	2·18	·984	8	18	107	140
London ...	...	H 1,680,786	17,347,746	10·32	·84	...	83	2,646	...	1·019	...	...	6·15	742·5	55	96
		E 48,777,026	516,092,489	10·58	1·04	...	113	8,732	...	·627	...	...	8·44	15,786·8	1,179	1,584
Newcastle ...	300,000	4,593,419	49,348,688	10·74	1·087	164	...	3,595	14·5	·59	1·58	·633	7	...	...	186
Northampt'n	90,076	652,074	6,497,622	9·95	·98	74·38	...	2,923	5·11	·531	1·34	·7	6·91	...	...	26
Portsmouth	236,732	2,204,042	25,039,320	11·36	1·066	110	84	3,593	9/5	·497	1·66	·62	7	1,086	72	100
Preston ...	120,000	936,553	9,000,070	9·61	1·02	75	130	3,802	6·9	·639	1·01	·95	7·36	380	20	30
Reading ...	75,500	917,045	8,279,650	9·02	·97	109	97	2,505	8·9	·57	1·59	·68	7	352	26	36
Sheffield ...	455,793	7,720,026	90,458,851	11·717	·896	198·465	101·3	4,403	14·10	·522	2·5	·416	7·274	3,018·78	208·192	269
Wellington...	68,000	2,269,840	23,262,433	11·01	1·33	342	93	4,316	42/8	·94	1·287	·76	8·01	786	68	85

E—Electric trolley system. H—Horse lines. (a) Including 8,955 miles coal haulage. (b) 123 cars all day.
(c) Includes tramway operating cost only, excludes cost bulk supply to lighting department.

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CONTRACTS AND ORDERS.

The Electric Construction Company are supplying 50-KW. negative boosters to Sheffield Corporation.

Mr. J. W. Courtenay has been appointed sole advertising contractor for the Ilford Council Tramways.

Newcastle Council have given a contract for the supply of steel tramway rails, at £3,625, to Dick, Kerr and Company.

C. A. Parsons and Company, Limited, have been awarded a contract for a turbo-alternator, at £7,292, to Derby Corporation.

Hurst, Nelson, and Company, of Motherwell, have received a contract to supply two new cars to Ayr Council, at £761 2s. each.

The United Electric Car Company have an order from Rotherham Corporation for supplying and fixing six top covers for tramcars.

Dewsbury Council have placed contracts as appended: Ferranti, Limited, switch panel, £266; Union Cable Company, fire-proof cable, £114.

Pearson, Huggins, and Company have secured a contract for the supply of uniform clothing for the tramway employees at Wolverhampton.

Hadfield's Steel Foundry Company, Limited, Sheffield, have received an order for points and crossings for Bradford Corporation, at £2,712.

Nelson Council have placed contracts with the Tudor Accumulator Company for a traction battery, and with Newton Brothers for a generator and booster.

Chesterfield Council have placed a contract at £1,461 with the British Westinghouse Company for a 500-KW. rotary converter and a 500-K.V.A. transformer.

Lincoln Council have accepted the tender of J. Howden and Company for a boiler, stoker, superheater, economiser, chimney, and induced draught flues, at £3,086.

Messrs. Briggs, Jones, and Gibson have obtained a contract for the supply of uniform clothing to Accrington Tramways Department. For caps the tender of Zeffet and Company has been accepted.

The British Westinghouse Electric and Manufacturing Company, Limited, have been selected by Grimsby Corporation as the manufacturers for a 1,000-KW. turbo-generator and condenser, at £7,524.

R. W. Cameron and Company, Sydney, have received a contract to supply 100 tons of fish bolts for 80-lb. rails, at £15 per ton, for railway and tramway construction by New South Wales Public Works Department.

Bootle Corporation have accepted tenders from Callender's Cable and Construction Company for V.B. wires and cables; from British Insulated and Helsby Cables for fuse boxes and terminals; and from Doulton and Company, Limited, for stoneware troughing

A. Blyde and Company, the Wallace Steel Works, Sheffield, have received intimation that Middlesbrough Council have again accepted their tender for the supply of their special "Crutch brand" tool steel, cast steel, etc., for the ensuing twelve months.

Birmingham Corporation Tramways have placed a contract for the supply of tantalum traction lamps for the whole of the cars for the ensuing year with Siemens Brothers Dynamo Works, Limited. It is anticipated that some 20,000 lamps will be required.

Rochdale Council have accepted the following tenders: W. H. Allen and Company, turbo-alternator; J. Howden and Company, turbo-alternator; General Electric Company, motor alternator; R. and T. Howarth, Rochdale, erection of extensions at the electricity works.

Bolton Council have accepted the following tenders: John Musgrave and Sons, Limited, two turbo-alternators of 4,000 KW. each; Babcock and Wilcox, Limited, four water-tube boilers including superheaters and stokers: Green and Son, four sets of fuel economisers.

Messrs. Siemens Brothers and Company, Limited, Caxton House, Westminster, have received an order, at £11,572, for the supply of electric generating plant, ice-making plant, etc., to the British Legation in Pekin. In reply to a question in the House of Commons on March 17, Mr. Benn stated that the firm is a British one.

Glasgow Corporation have allotted contracts as subjoined: Steel step treads, H. and F. Bonten, Limited: armature coils, British Westinghouse Electric Company, Limited; porcelain insulators, Bullers, Limited; copper bonds, R. R. Todd: Witting armature coils, Manchester Armature Coil Company: Witting commutators, Mavor and Coulson.

Liverpool Corporation have placed a contract for the supply and erection of four cooling towers at Lister Drive power-station with the Worthington Pump Company; for insulated cables and wires, Liverpool Electric Cable Company and the Anchor Cable Company; and for cables and accessories for mains for three years with Callender's Cable and Construction Company.

Darlington Council have allotted contracts as subjoined: Richardsons, Westgarth, and Company, Limited, one 1,000-KW. alternator coupled to a steam turbine; British Westinghouse Electric and Manufacturing Company, Limited, one 750-KW. and one 250-KW. rotary converters; Babcock and Wilcox, one water-tube boiler to evaporate about 15,000 lb. per hour.

Southend Council have allotted contracts as subjoined: Edgar Allen and Company, Limited, 20 manganese iron tongues for tramways, £90; Watlington and Company, poles, brackets, trolley wire, section pillars, and bonds, £801; Mr. D. B. Rose, gun-metal overhead line material, £41; Aiton and Company, steam pipes, £35, and exhaust pipes, £76; Hopkinson and Company, steam valves, £76; Glenfield and Kennedy, exhaust valves, £23.

Bradford Council have awarded contracts as follow: Walter Scott, Limited, steel rails, £7,750; British Mannesmann Tube Company, steel poles, £5,222; Hadfield's Steel Foundry Company, points and crossings, £2,712; Bayliss, Jones, and Bayliss, Limited, tie bars, £197; Jonas Wells, Limited, malleable iron castings, £603; A. G. Barrett and Company, iron castings, £415; R. W. Blackwell and Company, copper bonds, £326; Thermit, Limited, welding portions, 19s. 6d. each; Cox-Walkers, Limited, voltage regulator, £343.

London County Council have accepted the following tenders:

Dick, Kerr and Company, three 1,500-KW. rotary converters for Shoreditch substation, £8,022; Williams and Bach, wiring of Camberwell and Cressy Road car sheds, £2,139 11s.; Thermit, Limited, welded portions of 1,000 rail joints, 19s. 6d. each, with five additional welded portions free of cost for every 100 ordered; Watlington and Company, four towers for fitting to existing motor wagons, £292; National Rail and Tramway Appliances Company, four hydraulic pit jacks for Camberwell car shed extension, £35 10s.; Standard Engineering Company, smiths' hearths and exhaust and blower fans for Leven Road, Poplar, and Battersea wharf permanent way depots, £166 17s.; Siemens Brothers Dynamo Works, 125,000 drawn wire metallic filament traction lamps, £7,800, and 380 yards high-tension cable, £248 5s. 10d.; Lilleshall Company, special section rolled steel bar for magnetic brake shoes, £8 2s. 6d. per ton, total amount, £4,745.

Liverpool Council have placed contracts as follow for annual supplies to the electricity and tramways departments: Ashmore and Company, M. Simpson and Company, and Killick and Cochran, wrought-iron lamp standards, brackets, etc.; Killick and Cochran, cast-iron columns and plugs; G. Atkins and Sons, Atlas Lubricating Company, Goodlass, Wall, and Company, Homelight Oil Company, J. Matthews and Company, Siddall and Company, S. D. Stead and Son, J. and J. Taylor and Company, W. R. Taylor and Company, United Alkali Company, and J. and W. Wilson, Limited, oils, paints, etc.; L. Berger and Sons, Goodlass, Wall, and Company, Meredith and Company, and Wilkinson, Heywood, and Clark, varnishes and special paints; British Lubricants, Limited, R. Davidson and Company, Dee Oil Company, and Vacuum Oil Company, lubricating oils and greases; R. Roberts and Sons, brass and copper castings; P. L. Jones and Company, wood casings and sundries.

Melbourne Railway Electrification Contracts.—The following contracts for electrical equipment in connection with the electrification of Melbourne suburban railways have been awarded: Power-station, buildings, boiler-house equipment, and other plant (deposit, £6,455 10s.), £258,220, Babcock and Wilcox, Limited; equipment of suburban stations (deposit, £4,200), at rates, Siemens Brothers Dynamo Works, Limited; turbo-alternators and transformers (deposit, £3,656), £122,235, C. A. Parsons and Company; train equipments (deposit, £16,904), £676,180, General Electric Company, United States. Mr. W. Fitzpatrick, chairman of the Victoria Railway Commissioners, is now leaving for Europe and America in order to study the latest electrical railway systems, especially in regard to matters affecting that part of the electrification of the Melbourne Railways not yet sanctioned by Parliament, notably electric signalling apparatus. On March 11 Mr. E. Blazey, goods service superintendent, and Mr. F. C. Calcutt, engineer of signals, left on a similar mission.

Sheffield Corporation have placed contracts for the tramways department as follow: Armature washers, Samuel Peace and Sons; controller fittings, Dyer and Young; weldless steel tubes, British Mannesmann Tube Company; trolley wheel spindles, Samuel Peace and Sons; car electrical supplies, G. W. Allsop, J. Turner and Sons, and Edison and Swan United Electric Light Company; electric bell spares, Hallamshire Electric Company; electric light fittings, J. Thompson and the General Electric Company; cable, etc., I.R., G.P., and T. Works Company; fibre trolley sleeves, Tramway Supplies, Limited; rubber materials, G. Maclellan and Company and the I.R., G.P., and T. Works Company; insulating cloths, tapes and linen, L. Andrew and Company, W. T. Henley's Telegraph Works Company, Spicer Brothers, T. A. Ashton, Limited, and E. Inman and Company; car furniture, M. Bonser and Company, Gabriel and Company, Player and Mitchell, R. and H. F. Phillips, G. W. Allsopp, W. S. Laycock, Limited, and Samuel Peace and Sons: springs, Cocker Brothers, Tempered Spring Company, and J. P. Skinner and Company: slipper blocks, George Miles: brushes, R. Richmond and Sons, C. Hoyland and Son, and G. B. Kent and Sons; glass, Pilkington Brothers, Alfred Webb, and the Hallamshire Electric Company; overhead line material, Brecknell, Munro, and Rogers, M. Bonser and Company, Tramway Supplies, Limited, S. Peace and Sons, Fleming, Birkby, and Goodall, and Veritys, Limited; h.c. copper and lead wire, to be made up into cables, W. T. Glover and Company.

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PERSONAL.

Mr. Spurr, York city engineer, has been granted an increase in salary from £500 to £550.

Mr. F. H. Corson, Gloucester city electrical engineer, has had his salary increased from £350 to £400.

Mr. W. H. Woods, of Durham, has been appointed shift engineer at the Stuart Street station, Manchester.

Mr. T. de Courcy Meade, city surveyor of Manchester, has had his salary increased to £1,400 per annum.

Mr. R. Withycombe has been appointed director of electrical works and railways to the Zanzibar Government.

Mr. James Stott, on account of ill-health, has resigned his position as electrical engineer and tramways manager of Heywood Council.

Mr. G. L. Bruce, electrical engineer and tramways manager to Lowestoft Council, has written to the Council resigning those appointments.

Mr. A. J. Abraham, engineer and manager of Aberdare Urban Council's electricity department, has been appointed manager of the tramways department.

Mr. H. S. Kennedy has been appointed manager of the marine department of Messrs. Siemens Brothers Dynamo Works, and will be stationed in Glasgow.

Mr. H. H. Couzens is resigning his position as chief manager and engineer of the Hampstead electricity department in order to take up a lucrative appointment abroad.

Mr. W. Clough, tramways manager to Bury Corporation, has been granted an increase of salary from £400 to £450, with a further advance of £50 at the end of twelve months.

Mr. W. Glendinning, cashier to Belfast tramways department, has been granted a retiring allowance. He has been in the tramway service since 1872, and retires on July 1 next.

Mr. A. Prentice, of the Central London Railway power-station, has been temporarily engaged as station superintendent to the Walsall electricity undertaking, with a view to a permanent appointment.

Mr. J. Fry has been appointed secretary to the Buenos Ayres Port and City Tramways, Limited, and the Buenos Ayres City and Suburban Tramways, Limited. The offices are at 4, Moorgate Street, E.C.

Mr. Arthur Ellis, electrical engineer and tramways manager to Cardiff Corporation, has been presented with a silver salver by the electricity and tramways department as a token of esteem and respect.

London County Council Stores Committee.—The following are the members of the committee on stores and contracts for the current year: Miss Lawrence, and Messrs. G. Dew, W. H. Ecroyd, W. Haydon, C. Jesson, O. Lewis, H. E. S. Parsons, and J. Salmon.

Bournemouth Tramways Staff.—The following increases of annual salaries have been made in the tramways department: Mr. H. Vickers, chief assistant and electrical engineer, £50; Mr. Baker, chief clerk and cashier, Mr. R. O. Baldwin, traffic superintendent, and Mr. Hartley, works superintendent, £25.

Alderman Nye, who has for many years advocated the municipalising of the public services of Hove, has resigned his membership of the Traction Committee. He disapproves of the opposition which has been shown by the Council to the carrying out of the railless trolley car scheme, for which powers were obtained last year.

Union Internationale de Tramways et de Chemins de Fer d'Interet Local.—M. Henri Camp, engineer, has been appointed general secretary of the International Tramways and Light Railways Union in succession to the late M. Paul t'Serstevens. The headquarters of the Union are at 15, Avenue de la Toison d'Or, Brussels.

Mr. F. Burt, a motorman on the Hastings Tramways, has been appointed inspector on the Oxford Tramways. Before leaving Hastings he was presented with a biscuit jar from the members of the Tramways Rifle Club, and a salad bowl and servers from the employees generally, Mr. T. B. Holliday, the manager, making the presentation.

Alderman Flint, chairman of Leicester Tramways Committee, who entertained a large company at tea after the inauguration of the P-A-Y-E system on the double-deck cars, recently paid a visit to America. What he there observed of the working of the payment-on-entry system was largely responsible for his advocacy of it at Leicester.

Tramways and Light Railways Association.—The Rt. Hon. Viscount Chilston has been elected president of the Tramways and Light Railways Association. Lord Chilston, as the Rt. Hon. Akers Douglas, was Home Secretary in 1902-6, having previously been Parliamentary Secretary to the Treasury, and First Commissioner of Works. He is chairman of the Tramways, Light, and Power Company.

Huddersfield Tramways Cashier.—In addition to Mr. G. M. Barnett, of Leeds, who was appointed cashier to Huddersfield tramways department, the other candidates interviewed were: Messrs. F. W. Ellis, Bradford Tramways; H. A. Slater, Salford Tramways; B. M. Bagott, Halifax Tramways; L. H. Shearman, Hull Tramways; W. T. Swindells, Manchester Tramways; and W. J. Thomas, L. and N.W. Railway, Huddersfield. There were 300 applicants.

London County Council Tramways.—The Highways Committee, which has control of the tramways, has been constituted as appended for the ensuing year: Messrs. H. E. A. Cotton, B. B. Evans, A. O. Goodrich, H. H. Gordon, G. H. Hume, and W. Hunt, Capt. A. C. H. Kennard, Mr. H. Lidiard, Lord Monk Bretton, Messrs. J. T. Prestige, A. C. Rawson, A. H. Scott, W. J. Squires, and H. Ward, Sir Edward White, and Mr. A. W. Yeo.

Mr. T. Ridyard, works manager of Manchester Corporation Tramways, was appointed on March 21, out of 89 applicants, to the position of rolling stock and works superintendent of Liverpool Tramways. The choice was narrowed to six candidates, and on March 14 the list was reduced to Mr. Ridyard and Mr. A. Crossley, assistant rolling stock superintendent at Sheffield. The Tramways Committee had interviews with each candidate before making their final selection. Mr. Ridyard's salary will be £350 a year.

Lowestoft Appointments.—In consequence of the resignation of Mr. Bruce, the electrical engineer, the Council have made the following appointments: Mr. W. R. May (assistant engineer) to be borough electrical and mechanical engineer, at a commencing salary of £250 per annum, increasing to £280 by annual increments of £10; Mr. H. H. Saunders (chief clerk) to be general manager of the electric light and tramways, at a salary of £220 per annum, increasing by £10 per annum to £250.

Mr. S. T. Allen, Carlisle city electrical engineer, has been appointed electrical engineer to the Wolverhampton Corporation, in succession to Mr. C. E. C. Shawfield, resigned, at a salary of £600. The Electricity Committee has made the following increases in salaries as from October 1 last: Mr. Stubbs, technical and general assistant, £160 to £200 per annum; Mr. Bellhouse, boiler-house superintendent, £125 to £150; Mr. Forder, engine-room superintendent, £120 to £150; and Mr. Platt, junior assistant, £85 to £104.

Alderman Bowes, chairman of Manchester Tramways Committee, on March 11 presented Mr. Bowie with a silver-chased key from the members as a memento of the part he had taken in fixing the new public clock outside the tramway offices in Piccadilly. In the course of the proceedings, Alderman Bowes referred to the £100,000 grant which the committee had made in aid of the rates as the greatest ever voted in Great Britain, and stated that the committee were very proud of the fact. Last year the amount was £75,000.

Para Electric Railways Management.—At the annual meeting of the Para Electric Railways and Lighting Company, Sir W. Evans Gordon, who presided, stated that in the spring of 1912 the manager in Para (Mr. P. C. Barley) was taken seriously ill, and was compelled to return to England, and, they regretted to say, had been unable to resume his work in Para. Mr. C. H. Julius (of Messrs J. G. White and Company, Limited, their engineering managers) at once proceeded to Para, where he remained for several months. The directors very fully appreciated his efforts and ability in the operation of the property, and in reducing operating expenses.

Mr. Harry Webber, borough electrical engineer, Keighley, on March 18 was appointed tramways manager in that borough, as from October 15 last. The total salary will be £600 per annum. Councillor A. Smith, chairman of the Tramways Committee, in moving the appointment, said that Mr. Webber had dealt in a perfectly satisfactory manner with some important things, including the railless car system, during the time he had had control of the tramways. There was some opposition to the proposal on the ground that important matters were coming up in connection with both the electricity and tramway departments which would need individual supervision, but the appointment was approved by the Council.

Mr. Charles Mittelhausen, late engineer and manager to the Bexley tramways and electricity undertaking, was recently entertained to dinner at Whitehall Court by the tramway managers of the Greater Metropolitan area. The chair was occupied by Mr. H. E. Blain (West Ham), others present including: Messrs. A. Coveney (Erith), S. Dudman (Dartford), W. E. Hammond (Metropolitan Electric), L. E. Harvey (Ilford), A. V. Mason (South Metropolitan), F. Schofield (Leyton), H. P. Stokes (Bexley), and W. C. Ullmann (East Ham). Messrs. Goodyer, Holmes, Murray, and Pott were unavoidably prevented from attendance. All present expressed their appreciation of Mr. Mittelhausen's official and personal qualities, and their good wishes for his health and success in his new sphere.

Increases of Salaries at Manchester.—The following augmentations of salaries have been made by the City Council in the tramways department: Mr. J. Wood, financial superintendent, £475 to £500 (maximum); Mr. J. T. Oakes, traffic superintendent, £450 to £475 (maximum £500); Mr. F. A. Mitcheson, accountant, £375 to £400 (maximum); Mr. G. R. Blackburn, rolling stock superintendent, £350 to £370 (maximum £400); Mr. R. Beattie, chief claims clerk, £325 to £350 (maximum); Mr. T. G. King, stores superintendent, £250 to £275 (maximum £300); Mr. H. Jackson, chief clerk, traffic department, £240 to £250 (maximum); Mr. J. W. Hewitt, cashier, £225 to £245 (maximum £300); Mr. W. Grey, chief clerk, general office, £220 to £235 (maximum £250); Mr. C. H. Pepper, assistant accountant, £205 to £220 (maximum £250).

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TRAMWAY AND LIGHT RAILWAY NOTES.

BIRMINGHAM.—Owing to extensions of the tramways, and to an increase in the traffic on the older sections, the Tramways Committee have decided to increase the stock of 511 cars. As a first instalment 40 more cars are to be purchased.—Sir Arthur Yorke, of the Board of Trade, recently visited Brierley Hill to inspect the routes of the Birmingham and Midland Tramways Company, for which amended powers had been applied for, viz., to increase speed limit from eight to 10 miles per hour; removal of the four miles limit between Level Street and the Town Hall on market days; and to do away with the four compulsory stopping places.

BLACKPOOL.—The promenade tramway at Blackpool has been relaid in little tar-cobbled oblong setts, fixed in grey squares, thus making the track stand out very distinctly. A local journal welcomes the alteration as one calculated to prevent the risk of accidents through people walking unawares on to the tramways.

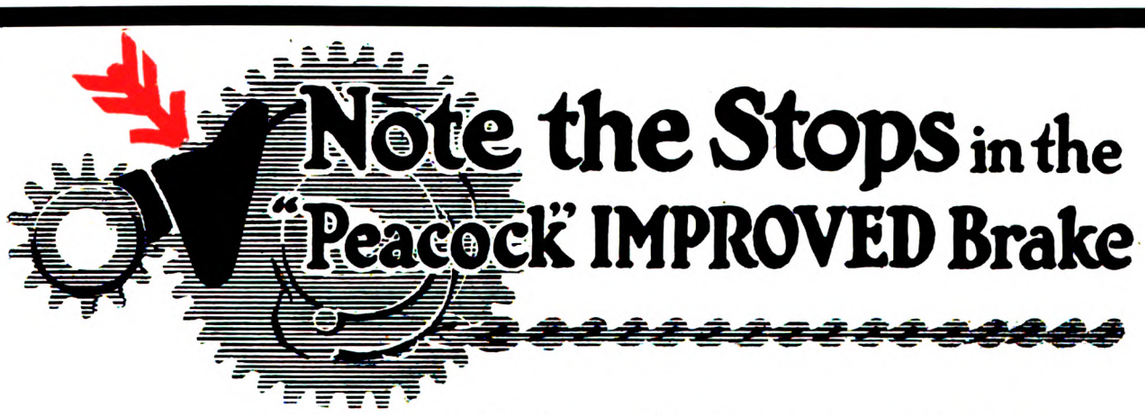
BRADFORD.—The system of workmen's fares of a halfpenny up to 9 a.m. has now been in operation since May, and has resulted in loss. Comparing the periods of 1911 and 1912 from May to December of traffic to 9 a m., there is an increase in car-mileage of 92,738 and a decrease in receipts of £2,394. Traffic up to 9 a.m. is carried with a revenue of 6·87d. per car-mile, while the total cost is 9·85d. The committee have decided to give the policy a full year's trial. At an estimated cost of £8,592, alterations and additions are to be made at Thornbury car depot.—At the central tramway office a female staff numbering 15 or 16 is employed in checking the tickets, punches, and way-bills of the conductors. By this system the takings are arrived at independently of the cash department, which counts the money actually taken. It is interesting to note, the general manager states, that though the takings amount to between £800 and £1,000 a day, the results arrived at by the two departments balance to within a halfpenny.—According to a statement made by the chairman of the Highways Committee of the Baildon Rural Council, it was at first proposed to construct a single line for the proposed tramway between Bradford and Baildon, but now the idea is to put down a double track "in order that Bradford might bring great crowds on holidays and at other times to Baildon Moor."—The Lord Mayor of Bradford, Alderman Foster, on March 17 acted as motorman of the first car over the extension of the Bradford tramways from the Wyke boundary to Bailiff Bridge. This extension places Bradford in direct communication with Brighouse, and provides an extended circular route to Halifax, this being the third alternate route to that town.

BRIGHTON.—Brighton Corporation have adopted a suggestion by Mr. W. Marsh, tramways engineer and manager, that 50 of the worst joints on the Dyke Road track should be fitted with renewable plates in order to obviate noise. The New England Road track is to be renewed at a cost of £4,183. In connection with the recent renewal and improvement of Grand Parade track, the Council have adopted a resolution submitted by the Tramways Committee, congratulating Mr. Marsh on the expeditious and convenient manner in which the work had been carried out, especial mention being made of the little obstruction occasioned to traffic. Mr. Marsh has reported that the total cost of the track renewal to March 7 was £3,523; an average length of 350 ft. of track being relaid a week, against an average of 212 ft. in the case of Grand Parade.

COVENTRY.—The Tramways Committee have directed the manager to advertise for tenders for the erection of new car shed, stores, etc., and to obtain quotations for various supplies required in connection with the extensions at the tramways depot. The manager has also been authorised to place new destination indicators upon all cars suitable for the purpose. The Board of Trade have sanctioned the construction of several additional passing places.

CROYDON.—The Council have adopted the recommendation of the tramways manager that the Whitehorse Road route should be closed. The first report on the route showed a loss of £1,150, and two further trials witnessed increases in the loss to £2,916 and £3,700. In order to better compete with the London motor omnibuses the Council elsewhere have lengthened the penny stages and instituted three-halfpenny stages, but they wisely rejected a motion which sought sanction for halfpenny stages.

GLASGOW.—The Tramways and Electricity Committees recently took over the 5,000-KW. turbine installed at the Pinkston power-station of the tramways department by Richardsons, Westgarth, and Company, West Hartlepool, the condensing plant being supplied by Mirrlees Watson Company. Three years ago the Corporation installed a turbine of 3,000 KW. capacity, and this, with the aid of the original engines, carried the whole load. Now the whole of the traction load will be borne by the two turbines, and the original engines will only be utilised in case of emergency. It is estimated that the turbines will save, in coal alone, a sum from £2,500 to £3,000 per year. The new turbine and generator cost about £10,200, making in all £20,400 for both turbines, as compared with £102,000, which was the cost of the original plant. Bailie Kirkland, the convener, and Bailie Alston, sub-convener, respectively admitted steam into the new turbine and turned it off from the old engines. The first-named, in proposing prosperity to the



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manufacturers of the machinery, remarked that the Corporation would have to consider the question of removing all their reciprocating plant and installing turbines. Bailies Kirkland and Alston, of Glasgow Tramways Committee, and two members of the Statute Labour Committee, accompanied by Mr. T. Nisbet, master of works, Mr. J. Ferguson, chief engineer of the tramways department, and the deputy town clerk, on March 15 visited Barrow-in-Furness to inspect the bascule bridge which forms the means of communication between Barrow and Walney Island, and across which tramway cars run. Glasgow Council are about to consider a scheme for providing communication by a bridge across the Clyde west of Jamaica Street Bridge.

HASTINGS.—The Board of Trade have intimated to the Town Council that the increase in the number of "live" studs on the Hastings Front is so great that the Board propose to condemn the system six months hence. The Council, who had decided to oppose in Parliament the company's bill for power to substitute the overhead trolley system, have accepted an invitation from the tramways company for a committee to meet the management with a view to discovering some means to satisfy both sides.

LEEDS.—The City Council have adopted a scheme for building a new tramways depot and necessary offices connected therewith, and a club for the men, upon land in Sovereign Street, at an estimated cost of £22,000. Alderman Tetley stated that accommodation would be provided for 56 cars. It was proposed to run from this depot most of the part-day cars, thus effecting a more economical and speedy running. The architects are Messrs. Chorley and Connon.—As the result of a month's trial of collecting on the platform the fares of passengers *en route*, Mr. Daggett, traffic manager, has stated that the inspectors reported there were far less mis-fares now than formerly. The public had taken very kindly to the new system. They realised that it meant no extra trouble for themselves, whilst, without doubt, it did away with a great deal of quite unnecessary fatigue for the conductors.

LIVERPOOL.—The new experimental bogie car, with central platform, separate exits, entrances, and staircases all situated in the centre of the car, was put in service on March 13 on the Aintree-Aigburth route. This car, which was illustrated and described in our issue of December 12, 1912, is one of two experimental vehicles designed by Mr. C. W. Mallins, general manager of the Liverpool Corporation Tramways, and built by the United Electric Car Company, of Preston. The other special vehicle is the double-staircase (two at each end) car which came into operation some two months ago on the same route, and which has also been fully described in these columns. Since these cars were delivered by the builders, tramway managers from all parts of the country have visited Liverpool to inspect the new vehicles, and Mr. Mallins has received many congratulations on the ingenious contrivances embodied in their construction. The feature of the second car—apart from the novelty of the central platform—is the provision of gates and barriers which keep the two streams of passengers, incoming and outgoing, in separate channels. The same principle is observed in the earlier car, but the arrangement is quite different. The number of first-class cars has been increased to 62, out of a total of 572 cars.

LONDON. Leyton is the latest tramway authority outside the county to institute return fares between that district and London, in order to meet motor omnibus competition. The General Purposes Committee of the Leyton Council have also discussed the question of a general reduction of fares, as on the London tramways. One of the Leyton-London return fares is fourpence to Liverpool Street Station, the opening of the extension of the Bishopsgate Street line to the station taking place on Good Friday. The extension obtained a free advertisement in the daily newspapers as a means for taking Londoners to Epping Forest and back at sixpence return. Another destination in the Forest is Chingford, which may be visited for a return fare of sevenpence, the journey, after passing the London boundary, being over the lines of the Leyton and Walthamstow Councils. The County Council's tramways department would be better able to meet competition if a publicity department were instituted. Several enterprising members of the Municipal Reform party on the Highways Committee recognised this want at the period when the return fares at reduced rates were instituted all over the system, and they unsuccessfully endeavoured to persuade the committee to advertise the reductions in the newspapers. This form of publicity is paid great attention to by the London General Omnibus Company. At an estimated cost of £22,500, the County Council have decided to carry out road widenings of the Bromley Road, a main avenue for through traffic, in connection with the extension of the tramways from Catford to Southend Village. Lewisham Council are expected to contribute one-third of the cost.

MORECAMBE.—The Edison-Beach accumulator system is stated to be under consideration for the electrification of the Morecambe horse tramways.

SHEFFIELD.—In a lecture recently delivered at Sheffield, Mr. A. R. Fearnley, the tramways manager, stated that the Council had decided that arrangements were to be made by which a second supply of power would be available from the large Neepsend supply station, in the event of the failure at any time of the Kelham Island plant. This extra supply would also be available at holiday times and for football traffic. To give some idea of what the difference meant between the ordinary morning supply and the supply for football traffic, he mentioned that at 11 a.m. on an ordinary morning 2,500 H.P. was sufficient to supply all the needs of the tramway service, but when there was a big football crowd to be conveyed, 7,000 H.P. was needed for the tramways.

WALLASEY.—The Tramways Committee have decided to recommend the Council to rescind the extension of the penny stages instituted a year ago.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS.

Applications for Letters Patent have been filed:

4,618 Selective signalling systems—Western Electric Company, Limited (*Western Electric Company*).
4,627 Belt-driven transmission gearing for motor road vehicles—C. H. Reynolds.
4,681 Life guards for motor vehicles—G. L. Cumberland.
4,803 Wheel-guards for motor omnibuses—C. S. Snell.
4,822 Life-saving apparatus for motor omnibuses—J. Joseph.
4,836 Vacuum brake apparatus—S. Warner.
4,837 Steam superheaters for locomotive boilers—H. N. Gresley.
4,840 Apparatus for automatically taking up the slack in tramcar brakes—J. E. Anger.
4,924 Trolleys—R. H. King.
4,931 Section insulators, supporting ears, etc., for overhead conductors—J. Ramsey and A. W. Maley.
5,049 Reversible seats for tramcars—J. E. Anger.
5,092 Automatic train control and signalling system—A. Kerr.
5,200 Overhead systems of driving electrical vehicles—T. Tighe.
5,207 Point-operating mechanism—W. Dennis.
5,210 Street cars—F. Hedley and J. S. Doyle.
5,218 Life-guards for motor road vehicles—A. V. Brown.
5,225 Quick-action release valves for vacuum brakes—E. J. A. Nothin.
5,266 Automatic vacuum braking device—J. A. McLay.
5,346 Life-guards for vehicles—L. C. Chapman and S. R. Bailey.
5,377 Bogies and trolleys for self-propelled rail vehicles—J. Murgatroyd.
5,506 Apparatus for preventing side-slipping of the wheels of motor omnibuses—H. Martin.
5,537 Electric signalling systems—Sir A. T. Dawson and G. T. Buckham.
5,569 Mud-guards for motor omnibuses—J. Taylor.
5,668 Life-guard for motor omnibuses and tramcars—E. Giles.
5,670 Mud-guards for motor omnibuses—H. S. Casselton.
5,980 Axle boxes with removable guiding arrangement—D. Bailey.
5,996 Automatic brake slack adjuster for railway carriages, etc.—Birmingham Railway Carriage and Wagon Company, Limited, and E. O. Hill.
6,005 Double-deck cars—F. Hedley and J. S. Doyle.
6,074 Motor omnibuses—J. E. Anger.
6,144 Buffers for railway and tramway vehicles—W. Lofthouse.
6,186 Electric train signalling and controlling systems—A. J. Allard.
6,187 and 6,188 Life-guards for power vehicles—A. J. Gilbey.
6,296 Combined ears or clips and anchors for electric trolley wires for tramways—A. Welsh.
6,337 Life-guard for motor-propelled vehicles—W. A. Spain.
6,431 Guards for tramway cars—V. W. J. Smith and J. McQuaker.
6,665 Fenders for vehicles—T. Rabbitts and R. E. Aston.
6,756 Guards for motor omnibuses—V. E. Harris and C. H. Howe.
6,806 Electrical regenerative motor control systems—Crompton and Company, Limited, and H. Burge.
7,094 Rail joints—J. F. Barnhill.
7,117 Car couplings—E. F. Pendexter.
7,151 Control of alternating electric currents—British Thomson-Houston Company, Limited (*General Electric Company*).
7,184 Method of jointing the rails of permanent ways—A. E. Clayton.
7,213 Trolley wheels—M. E. Drake and D. B. Burnett.
7,305 Overhead conductors for electric traction systems—K. D. Bowen and Cedes Electric Traction, Limited.
7,386 Ejectors for vacuum brake apparatus—H. E. Gresham.
7,486 Route and speed indicators—A. E. Jones.
7,503 Variable gear for mechanically-propelled vehicles—R. Simpson.

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Specifications Published.

1912.

2,541 Passenger vehicles—Huppert and Paul.
2,808 and 2,809 Tramcars—Mallins.
3,146 Trolley head—Wood.
6,922 Safety apparatus for electrically propelled trains—Siemens Brothers Dynamo Works, Limited, and Lydall.
11,196 Means for preventing collisions on systems in which self-propelled vehicles are employed—Rottenberg and New Transport Company.
12,460 Tramway paving—Alcott.
13,233 Electro-mechanical propulsion systems for trains—Pieper.
21,734 Couplings for railway and tramway rolling stock—Heppell.
26,778 Controlling railway points and signals—Monard.
3,123 Electric railway systems—Deschamps.
4,249 Stop blocks and car pushers—Hohne.
4,264 Sockets or bases of trolley poles for electric traction systems—Monro and the R.E.T Construction Company.
6,555 Electric signal for use on locomotives—Wightman.
18,678 Steering of rail vehicles—Pintner.
21,831 Safety devices for the overhead conductors of direct or alternating-current installation—Bergamann Elektricitäts Werk Akt.-Ges.
5,218 Apparatus for automatically adjusting or taking up the slack in the brakes of tramcars—Anger.
6,048 Air brakes—Fyfe.
12,595 Ejectors for vacuum brake apparatus—Gresham.
18,845 Speed indicating apparatus—Beermann and Balzer.
6,050 Electrical signalling apparatus—Potts.
8,388 Urgency braking valve for air brakes—Rosenberg.
10,438 Construction of the car body of a motor omnibus—Dodson.
22,727 Railway rail—Heroux and Milette.

1913.

1,128 Tramcar signals and barriers—Mallins.
166 Device for lubricating tramway rails—Prosch, Kaufmann and Company, and Straus.

P-A-Y-E Cars at Aberdeen.—The ten payment-on-entry cars now in course of construction at Aberdeen will be placed in service on the Woodside route on April 28.

For **Directories of Electric Tramways and Railways,** *vide* pages xxv.—xxxiv. of this issue.

TRAFFIC RETURNS.

TRAMWAYS AND OMNIBUSES.

	1912. Weeks Ending.					1913. Weeks Ending.					Aggregate.		
	Mar. 2.	Mar. 9.	Mar. 16.	Mar. 23.	Mar. 30.	Mar. 1.	Mar 8.	Mar. 15.	Mar. 22.	Mar. 29.	Wks.	1913.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1.389	1.418	1.209	1.187	1.156	1.376	1.451	1.337	1.372	1.382	43	64,804	+ 1,729
Ayr Corporation	187	192	196	193	198	186	203	195	212	278	45	13.985	+ 492
Bath Electric	701	695	703	679	708	633	702	695	685	1.078	13	9.400	+ 606
Birmingham Corporation	9.578	9.680	9.675	9.315	9.578	11.165	11.338	11.344	11.032	12.620	52	573.072	+150,452
Blackburn Corporation	1.151	1.014	928	998	880	1.048	1.065	1.231	1.037	1.885	52	62.321	+ 3,223
Blackpool and Fleetwood	300	326	304	263	302	290	299	284	607	927	13	4,417	+ 917
Blackpool Corporation	954	442	379	383	412	472	726	494	571	2.507	52	73,458	+ 9.084
Bolton Corporation	2.360	2.325	2.307	2.168	2,244	2.535	2,417	2.516	3.071	2.631	52	134,845	+ 3.932
Bournemouth Corporation	1.553	1.524	1.520	1.616	1.566	1.643	1.626	1.601	2.628	1.857	52	95.694	+ 4,338
Bradford Corporation	5.026	4.937	5.602	5.003	4.995	5.224	5,305	5.112	5.684	6.954	52	289.617	+ 7,240
Brighton Corporation	817	789	751	786	822	750	789	786	965	1.097	52	51.651	- 493
Bristol	6.129	6.087	6.059	5.716	6.333	6.562	6.795	6.661	6,701	9.570	13	86,431	+ 10.076
British Elec. Trac. Co's. Undertakings													
Airdrie	275	289	307	300	309	291	299	314	318	358	13	3.815	+ 394
Barnsley	184	153	127	105	101	206	210	203	204	262	13	2.599	+ 567
Barrow	330	331	324	324	329	322	341	327	428	447	13	4.281	+ 416
Birmingham and Mid. Joint Com.													
Birmingham and Midland	916	920	930	895	906	933	966	945	974	1.237	13	12.132	+ 1,125
Dudley-Stourbridge	846	807	762	724	748	850	860	840	852	1.315	13	10.798	+ 1.479
South Staffordshire	896	910	1.044	865	870	958	996	1,001	976	1.394	13	12.645	+ 1.809
Wolverhampton District	468	467	456	449	445	473	509	494	494	703	13	6.277	+ 773
Devonport	504	504	501	499	530	456	504	495	524	595	13	6.382	+ 264
Gateshead	1.019	1.020	994	980	963	1.072	1.118	1.133	1.144	1.152	13	13.469	+ 1.119
Gravesend and Northfleet	197	192	196	200	193	204	206	212	209	252	13	2.619	+ 197
Greenock-Port Glasgow	757	745	784	802	762	736	767	758	746	905	13	9.231	+ 439
Jarrow	128	129	137	143	132	133	128	134	136	161	13	1.594	+ 94
Kidderminster	99	91	90	88	92	93	93	92	95	187	13	1.228	+ 112
Merthyr	196	189	165	151	155	189	216	199	207	322	13	2.643	+ 378
Metropolitan Electric	8.614	8.369	8.541	8.183	8.618	8.294	8.627	8.531	8.839	9.846	13	106.148	+ 3.859
Middleton	304	291	310	292	302	308	302	296	345	506	13	3.892	+ 433
Oldham-Ashton	563	559	577	577	573	593	584	574	665	773	13	7.374	+ 584
Peterborough	118	120	115	108	111	112	125	122	135	156	13	1.525	+ 117
Potteries	1.947	1.813	1.431	1.325	1.375	2.020	2.091	2.077	2.154	2.336	13	25.906	+ 3.757
Rothesay	50	50	51	53	54	52	51	54	68	293	13	901	+ 305
Sheerness	41	44	38	40	40	44	42	44	50	50	13	579	+ 55
South Metropolitan	741	720	797	755	829	697	734	730	754	950	13	9.125	+ 276
Southport	243	255	254	250	245	241	247	252	254	394	13	3.153	+ 331
Swansea	1.174	1.090	1.077	1.038	1.042	1.133	1.148	1.217	1.195	1.420	13	14.546	+ 1.089
Taunton	41	44	39	41	39	39	44	41	43	56	13	546	+ 48
Tynemouth	151	156	171	166	176	149	167	165	181	297	13	2.125	+ 357
Weston-super-Mare	28	24	24	21	24	22	24	28	54	222	13	541	+ 229
Worcester	242	254	247	226	239	228	239	244	268	385	13	3.164	+ 237
Wrexham and District	98	95	109	90	98	108	109	109	118	142	13	1.362	+ 210
Yorks. (Woollen) District	1.042	1.050	1.020	994	1.006	1.064	1.099	1.072	1.074	1.405	13	13.972	+ 1,455

(Continued on page 286.)

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TRAFFIC RETURNS—*continued.*

TRAMWAYS AND OMNIBUSES.	1912. WEEKS ENDING. Mar. 2.	Mar. 9.	Mar. 16.	Mar. 23.	Mar. 30.	1913. WEEKS ENDING. Mar. 1.	Mar. 8.	Mar. 15.	Mar. 22.	Mar. 29.	AGGREGATE. Wks.	1913.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Burnley Corporation	1.339	1.347	1.438	1.332	1.380	1.562	1.449	1.523	1.816	1.526	52	79.420	+ 7.513
Burton-on-Trent Corporation ..	257	261	259	257	259	249	256	271	274	291	52	14.156	- 397
Bury Corporation	1.160	1.261	1.241	1.212	1.188	1.257	1.267	1.231	1.500	1.357	52	67.314	+ 1.298
Cardiff Corporation	2.333	2.173	2.127	1.952	1.923	2.373	2.486	2.536	2.450	2.917	52	128.341	+ 2.862
Chatham and District	798	796	778	753	786	784	815	791	816	994	12	10.183	+ 557
Chesterfield Corporation	216	223	191	175	186	235	239	232	243	442	52	12.150	+ 504
Colne and Trawden	225	235	243	230	244	231	232	240	323	263	13	3.081	+ 268
Cork Electric	432	435	448	485	445	410	442	437	483	484	12	5.402	- 57
Croydon Corporation	1.682	1.627	1.720	1.660	1.766	1.405	1.473	1.439	1.470	...	51	88.158	- 2.085
Darlington Corporation	214	213	207	195	200	215	228	225	237	254	52	11.796	+ 369
Derby Corporation	856	848	833	495	501	863	901	887	964	1.097	52	46.558	+ 147
Dover Corporation	199	192	189	190	197	184	193	194	226	256	52	12.307	- 460
Dublin and Lucan	115	117	116	138	115	113	119	114	141	177	13	1.491	+ 80
Dublin United	5.322	5.310	5.396	5.562	5.541	5.144	5.512	5.302	5.316	5.886	13	67.771	+ 1.130
Dundee City	1.114	1.179	1.127	1.152	1.115	1.130	1.196	1.188	1.127	1.214	45	54.641	+ 1.872
East Ham Corporation	1.098	1.066	1.089	1.042	1.087	1.083	1.133	1.162	1.140	1.177	52	56.995	- 201
Exeter Corporation	276	271	276	263	275	258	277	272	272	398	52	16.621	- 581
Glasgow Corporation	18.194	18.748	18.927	18.914	19.016	19.411	19.822	19.305	19.540	20.403	43	822.816	+ 8.792
Glossop (Urban Elec. Supply Co.)..	119	122	129	70	46	118	119	122	134	130	13	1.587	+ 191
Halifax Corporation	1.771	1.766	1.789	1.813	1.702	1.815	1.789	1.798	1.746	2.755	51½	103.353	+ 3.784
Hastings and District	753	752	759	704	673	708	722	761	734	1.432	13	10.135	+ 858
Huddersfield Corporation ...	1.846	1.845	1.868	1.816	1.799	1.999	1.996	2.004	1.949	2.730	52	105.342	+ 5.149
Hull Corporation	2.964	2.934	2.938	2.841	2.840	2.970	3.070	3.015	3.125	3.149	52	156.491	+ 3.063
Ilford U.D. Council	487	477	477	462	398	407	426	427	451	489	52	24.254	- 3.039
Ilkeston Corporation	115	89	50	...	...	114	119	120	...	...	51	5.776	- 756
Ipswich Corporation	360	347	349	345	365	345	361	358	424	464	51	22.486	+ 218
Isle of Thanet	305	307	329	279	352	285	299	311	464	562	26	8.387	+ 344
Kilmarnock Corporation	149	140	137	128	141	147	153	153	157	165	45	7.391	-
Lanarkshire	1.405	1.356	1.222	1.107	1.171	1.510	1.504	1.521	1.544	1.704	12	19.299	+ 2.114
Lancashire United	1.281	1.233	1.114	1.105	1.078	1.302	1.363	1.335	1.311	1.967	12	16.761	+ 2.032
Leeds City	7.422	7.250	7.367	7.056	6.763	7.545	7.859	7.595	7.707	8.991	52	405.697	+ 16.419
Leicester Corporation ...	2.577	2.565	2.496	2.413	1.611	2.574	2.637	2.743	2.768	3.214	13	33.933	+ 2.873
Leith Corporation...	602	604	594	672	697	615	623	634	632	649	45½	30.411	+ 982
Liverpool Corporation	11.528	11.743	11.798	11.086	12.284	11.792	12.143	11.999	11.798	12.692	12½	151.912	+ 7.170
Llandudno and Colwyn Bay ..	145	145	148	155	147	164	165	166	215	420	17	2.900	+ 541
London County Council	43.167	43.234	43.161	42.469	43.602	39.340	40.716	40.674	40.270	41.227	52	2.151.925	- 104.099
London General Omnibus... ..	41.602	40.780	42.548	39.271	48.251	54.752	56.106	56.826	52.186	58.219	13	706.780	+ 194.146
London United	5.559	5.474	5.588	5.457	5.976	5.241	5.548	5.509	5.605	6.745	13	71.219	+ 831
Lowestoft Corporation	132	127	132	120	125	125	130	127	153	173	25	4.135	+ 65
Maidstone Corporation	153	152	150	141	153	154	166	160	159	201	52	9.739	+ 524
Manchester Corporation	16.298	16.538	16.765	16.147	16.700	16.848	16.621	16.623	16.816	17.827	52	874.658	+ 33.426
Nelson Corporation	162	176	176	192	146	176	174	175	229	246	52	10.240	+ 869
Newcastle-on-Tyne Corporation ..	4.167	4.180	4.187	4.052	4.087	4.542	4.614	4.726	4.664	5.136	52	235.313	+ 11.748
Newport (Mon.) Corporation ..	694	642	607	548	570	712	737	763	736	902	52	37.395	+ 1.550
New St. Helens and District ..	663	669	641	622	629	648	735	744	684	972	39	28.886	+ 1.218
Northampton Corporation... ..	485	506	462	480	479	487	509	501	510	682	51	27.963	+ 488
Nottingham Corporation	2.991	3.037	2.957	2.945	3.016	3.063	3.181	3.098	3.266	3.814	52	165.113	+ 4.123
Oldham Corporation	1.903	1.934	1.991	1.945	1.895	1.994	1.921	2.028	2.740	1.783	52	107.084	+ 6.720
Portsmouth Corporation	1.717	1.756	1.704	1.601	1.767	1.597	1.778	1.691	1.768	2.350	52	107.343	- 3.314
Preston Corporation	703	743	701	739	722	725	791	758	793	919	52	42.884	+ 2.608
Provincial...	1.494	1.506	1.490	1.447	1.572	1.522	1.622	1.565	1.744	2.111	26	42.093	+ 2.838
Reading Corporation	650	587	583	560	579	622	573	601	634	735	51½	33.326	+ 36
Rochdale Corporation	1.340	1.422	1.323	1.349	1.272	1.410	1.427	1.405	1.805	1.662	52	79.968	+ 7.504
Rotherham Corporation	670	638	572	570	581	869	880	892	871	1.219	52½	42.023	+ 6.862
Salford Corporation	4.758	4.764	4.785	4.633	4.725	4.880	4.758	4.758	5.446	4.886	52	259.549	+ 6.361
Sheffield Corporation ...	6.437	6 157	6.064	6.025	5.949	7.049	7.065	7.095	7.106	7.912	52	358.853	+ 22.262
Southampton Corporation... ..	1.129	1.085	1.098	1.068	1.078	1.043	1.110	1.130	1.144	1.345	51	63.354	+ 268
Southend-on-Sea Corporation ..	502	516	514	500	530	544	573	581	569	930	52	38.998	+ 4.900
South Shields Corporation ..	566	561	541	508	511	601	631	640	712	736	52	33.358	+ 1.434
Sunderland Corporation	1.195	1.162	1.169	1.125	1.114	1.213	1.327	1.298	1.405	1.582	52	68.453	+ 631
Swindon Corporation	164	139	141	115	123	138	139	142	146	190	52	8.031	- 209
Tyneside Tramways and Tramroads	435	449	435	452	434	486	464	488	454	899	13	5.912	+ 653
Wallasey Corporation	975	1.094	1.148	1.083	1.160	979	1.022	1.021	998	1.297	52	56.901	- 90
Walsall Corporation	576	569	541	494	475	594	602	592	608	787	13	7.665	+ 724
Walthamstow U.D. Council ...	661	649	666	627	776	638	664	682	714	812	52	37.010	- 1.009
Warrington Corporation	420	418	419	411	399	425	453	443	470	476	52	22.642	+ 1.541
West Ham Corporation	2.638	2.598	2.561	2.531	2.588	2.502	2.598	2.556	2.726	2.924	51½	136.070	- 3.423
Wigan Corporation	1.262	1.173	1.047	1.025	1.054	1.313	1.427	1.390	1.473	1.642	51½	70.375	+ 4.555
Wolverhampton Corporation ...	979	914	933	928	995	998	989	1.050	1.253	995	52	53.254	+ 2.824
Yorkshire (West Riding)	1.182	1.142	1.055	1.113	1.060	1.292	1.302	1.276	1.406	1.734	13	17.469	+ 2.159
FOREIGN TRAMWAYS.													
Anglo-Argentine	59.603	51.850	52.121	50.436	51.670	56.226	58.671	56.305	54.218	57.276	13	720.431	+ 52.326
Auckland ... ... (28 days)	...	...	17.463	...	...	...	...	19.566	...	...	37	179.095	+ 24.523
Bombay	2.982	3.127	...	...	...	3.110	3.351	...	...	...	10	29.862	+ 853
Brazilian Street ... (month) Mlrs.	42.423	...	...	...	...	46.044	...	...	...	...	30	311.166	+ 3.442
Brazilian Traction	...	...	...	...	...	93.150	92.404	92.608	92.404	93.743	13	1.162.533	—
Brisbane ... ...(month)	6.700	...	...	...	...	22.860	...	...	...	...	9	47.670	+ 23.936
British Columbia ... (month) $	473.036	...	...	...	...	546.040	...	...	...	...	34	4.566.538	+ 774.871
Buenos Aires Port and City (month)	6.726	...	...	...	...	6.269	...	...	...	...	9	12.697	- 1.100
Buenos Ayres Lacroze ...(month)	40.418	..	..	...	43.812	40.716	...	...	...	46.332	39	395.877	+ 37.927
Calcutta ... ... Rs.	60.578	61.242	58.884	59.580	59.938	65.510	67.166	64.660	62.068	61.404	13	8.42.592	+ 22.393
Cape Town ... ...(month)	11.667	...	...	...	...	12.195	...	...	...	...	9	26.090	+ 1.618
Carthagena and Herrerias (month)	1.755	...	...	...	2.396	3.053	...	...	...	3.695	13	10.072	+ 4.389
East India ... ...(month)	1.542	...	...	...	...	1.622	...	...	...	...	30	13.002	+ 2.265
Kalgoorlie ... ...(month)	2.684	..	...	...	...	2.644	...	...	...	...	9	5.378	- 190
La Plata ... ...(month)	4.243	..	...	...	4.468	4.942	...	...	...	5.771	13	16.288	+ 2.967
Lima ... ...(month)	31.297	...	..	...	...	32.250	...	...	..	...	9	66.450	+ 2.719
Madras ... ... Rs.	21.403	(2 weeks)	23.761	(2 weeks)	28.471	22.078	(2 weeks)	26.827	(2 weeks)	30.992	13	158.405	+ 13.857
Melbourne ... ...(month)	62.000	...	...	...	...	62.500	...	...	...	...	9	129.500	+ 3.500
Mexico ... ... (month) $	503.998	...	...	...	...	329.361	...	...	...	...	9	890.996	- 155.781
Montevideo ... ...(month)	35.021	..	...	...	31.494	34.368	...	...	...	33.140	21	169.675	+ 12.347
Para	4.262	4.020	4.229	4.089	3.894	4.087	4.399	4.498	4.333	4.007	17	70.516	+ 3.945
Perth (W.A.)	1.886	1.873	1.888	1.906	1.891	2.159	2.184	2.168	2.103	2.298	13	27.159	+ 2.946
Port Elizabeth ...(month)	3.251	...	...	...	...	3.590	...	...	...	...	9	8.088	+ 811
Shanghai ... ... $	19,166	16.456	19.344	18.470	16.981	19.400	20.800	20.000	19.200	20.000	12	237.800	+ 18.697
Singapore ... ... $	10.195	11.608	10.576	10.713	10.089	11.088	11.200	11.956	11.506	10.971	13	147.751	+ 12.004
Toronto ... ... (month) $	640.246	...	...	...	...	718.313	...	...	...	...	9	1,495.241	+ 198.885
Winnipeg ... ... (month) $	299.246	...	...	...	...	320.431	...	...	...	...	9	671.928	+ 53.248
ELECTRIC RAILWAYS.													
Central London	5.004	4.919	4.804	4.905	4.203	5.304	5.186	5.242	4.680	4.675	13	69.348	+ 4.612
City and South London	3.325	3.327	3.291	3.304	2.787	2.946	2.839	2.933	2.838	2.999	13	39.219	- 4.186
Great Northern and City	1.734	1.717	1.727	1.723	1.694	1.513	1.502	1.474	1.289	1.392	13	19.660	- 2.926
Liverpool Overhead	1.433	1.483	1.455	1.424	1.458	1.566	1.590	1.581	1.456	1.548	13	20.498	+ 1.356
London Electric	14.555	14.595	14.200	14.245	13.665	14.300	14.255	14.715	13.170	14.185	13	189.425	- 1.880
Mersey	2.178	2.153	2.078	2.017	1.954	2.263	2.255	2.220	2.198	2.177	13	29.239	+ 1.734
Metropolitan	16.346	15.402	15.322	14.721	14.489	15.901	15.725	15.957	15.713	15.952	13	212.134	+ 1.468
Metropolitan District	12.938	12.805	12,400	12.328	12.559	13.083	12.925	13.620	12.615	12.861	13	171.333	+ 6.422

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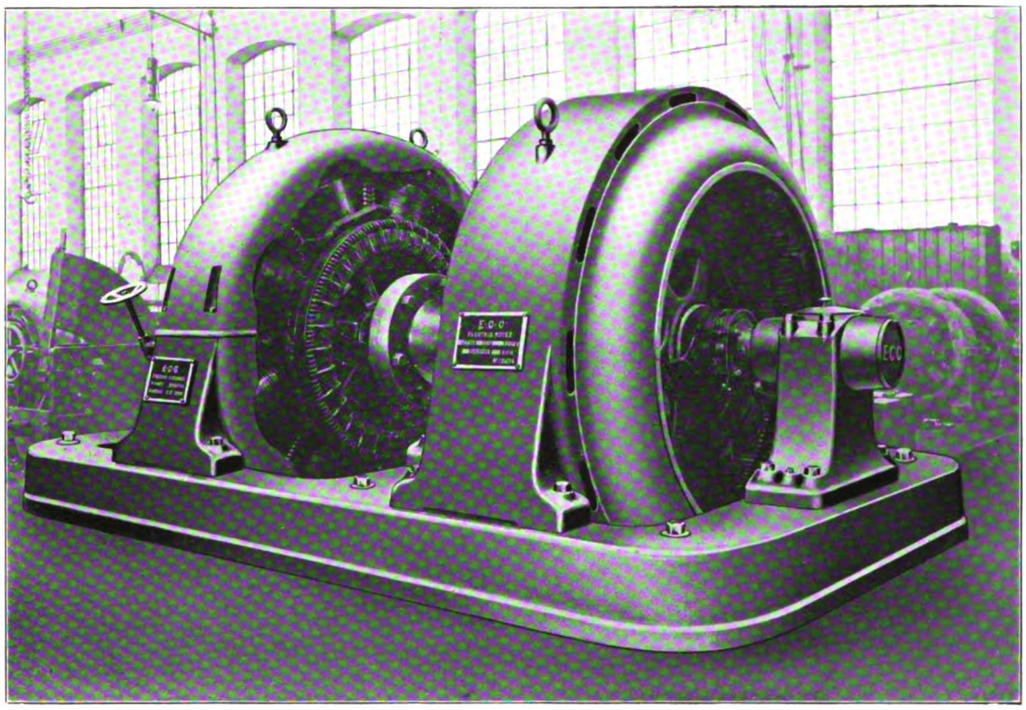

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TELEGRAMS—"Concordance," London.

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TELEPHONES—75 and 430 Wolverhampton.
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1,200,000 MILES

That is the distance covered by Six Maudslay Double-deck 'Buses between 1st Jan., 1906, and 31st Dec., 1912.

In the creation of this record, these 'buses travelled continuously over the hardest macadam route in Great Britain, and—

Each individual 'bus covered over 200,000 miles, and is still doing full service.

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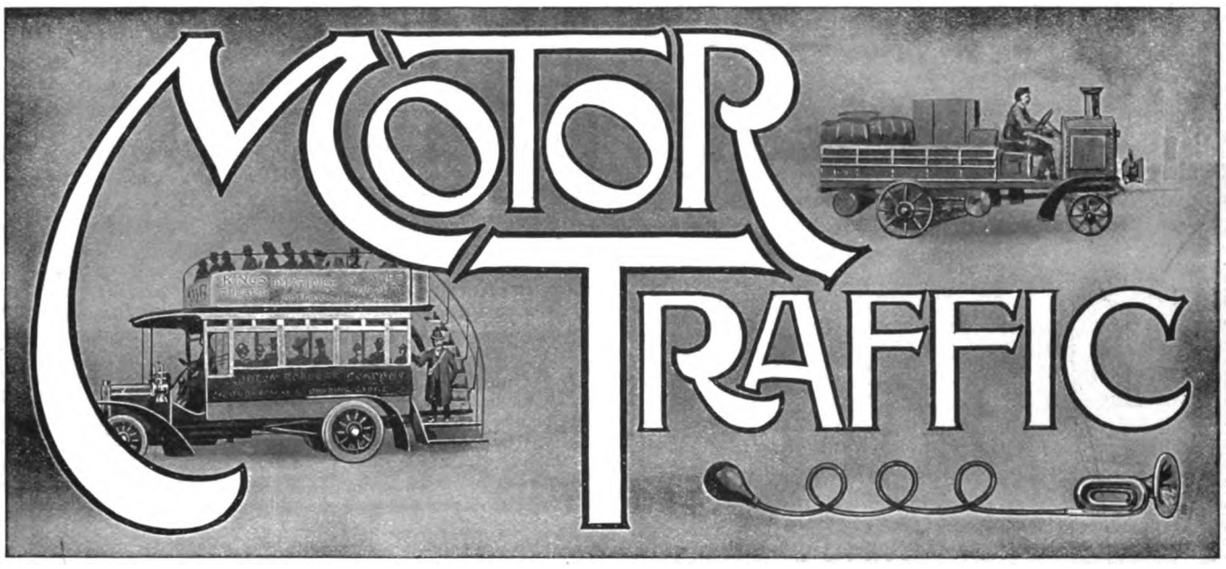

An absurd and harmful position is in danger of being created by House of Commons Committees by their calling upon local authorities promoting motor omnibus and railless trolley schemes to pay road maintenance charges in districts outside of their own areas. The innovation has only been made during the present session, and it is apparently to be attributed to a handful of legislators deputed to consider the Coventry Corporation Bill mistaking the quarters from which relief should be given to those who complain of the wear of the roads. Users of internal combustion engines have for three years paid a fuel tax in order to provide funds for the Road Board. The functions of that authority were stated by the Chancellor of the Exchequer, on March 11, in reply to an amendment to the King's speech proposed by Mr. Hayes Fisher. The member for Fulham urged that effect should be given to the recommendations of the Royal Commission on Local Taxation in favour of a large increase in the subventions from national funds in aid of local expenditure, and to fulfil the expectations of relief to local taxation held out in connection with the Budget of 1909. The money of the Road Board, Mr. Lloyd George declared, was not merely for the purpose of maintaining roads; it was for fitting them for motor traffic, and where necessary making new roads. As to the Royal Commission on Local Taxation, the Chancellor urged that nothing be done until a Departmental Committee now sitting had considered the question of areas. From both sides of the House members advocated that as motor traffic on the main roads has changed in character from local to general the Exchequer should bear the expenditure on trunk roads to the extent of three-fourths, instead of less than one-half.

Sixteen days later a Committee dealing with the Coventry Corporation's application for motor omnibus powers in the area of Warwickshire County Council, suggested that if the powers were to be granted an arrangement should be arrived at between the two authorities with regard to the question of the increased cost of road maintenance. Subsequently the Corporation withdrew the proposal to run outside the city boundary, the two authorities being unable to come to terms. The proposed innovation should be opposed as being likely to seriously hamper a convenience which the Corporation propose to provide at the request of the several localities. The unfairness of the proposal becomes more manifest when one remembers that a company can institute an omnibus service without applying for statutory authority, and that private promoters can also overcome the refusal of local authorities to license their vehicles by using private ground for the purpose of taking up passengers. That the House of Commons is not in sympathy with a departure from the policy of freedom for public traffic was indicated last session, when they deleted the clause inserted in Grand Committee on the Light Railways Act, requiring railless trolley promoters to contribute to road upkeep. Throughout the private bill legislation of that session the Committees resisted all appeals made to place such a burden on trolley omnibus undertakings, notwithstanding that a northern Corporation agreed to pay a contribution based on car-mileage to a County Council.

The question of road surfaces was introduced, a day after the debate in the House of Commons, by Mr. Rees Jeffreys, secretary to the Road Board, in a discussion on a paper on heavy motor vehicles, read before the Institution of Automobile Engineers. Mr. Jeffreys' study of road matters in this country was extended last autumn to America, where the hospitality of official circles and motoring organisations enabled him to gain an insight into American road questions and their effect on automobile construction. While pleasure cars are to be seen everywhere, Mr. Jeffreys asserts that the number of heavy vehicles is practically negligible owing to the non-suitability of the roads. His statement was, no doubt, intended to apply only to rural districts of that vast country; for everyone acquainted with automobile progress is aware of the remarkable development of electric motor vehicles in the larger American towns. Nothing like it is known in this country. A well-known English firm in public passenger and commercial vehicle construction has also been doing good business in petrol vehicles despite the import duty. Most interesting of Mr. Jeffreys' observations were the statements that it is because our roads are the strongest in the world that the heavy motor vehicle has developed more quickly here than elsewhere, and that the increasing number is raising questions which will come back very soon upon the motor manufacturer, and give a check to the vehicle unless he is prepared to deal with them in some form, or the community is willing to face the financial consequences.

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MOTOR TRAFFIC.

It is because all the roads are not strong that the Road Board's secretary foretells the possibility of trouble. His fears may be taken as a recognition not only of the representations which local authorities have made to the Government during the past year, but of the plea advanced in these columns on March 13, that the Road Board is an incomplete organisation and needs to be expanded into a Central Roads and Bridges Board, with certain powers of control. There is scope for a great extension of the Board's experimental work by the Engineering Advisory Committee in laying down trial lengths of different kinds of road crust. Experiments already conducted at Sidcup, Wandsworth, and Fulham have proved of great utility, and in the first-mentioned locality the value was increased by the traffic census taken at the beginning of a trial and repeated two years later. The census showed considerable increases in the numbers of motor vehicles of all descriptions. The knowledge imparted as the result of the trials, has apparently been responsible for the Lewisham Council deciding, on March 12, to re-surface motor omnibus routes with bituminous bound macadam, which is expected to last three years without repair, and to effect a considerable saving subsequently in the cost of maintenance, while minimising the dust nuisance and reducing the cost of scavenging and watering. As yet, the Road Board have given no attention to a trial of wood paving on a concrete foundation of the additional thickness required for heavy motor traffic. The results that would be apparent at the end of two years could be compared with those given by other materials, and if, as is likely to be the case, wood paving maintains the superiority it has always given over water bound macadam, its use would be most economical for urban localities.

Failure to note the widespread use of the commercial electric motor vehicle in America on the part of Mr. Rees Jeffreys afforded Mr. Webb an opportunity to describe its progress in the United States. Four thousand such vehicles were constructed last year by about 20 makers, who are doing an increasing business. This is due to the success achieved by the new storage battery which Mr. Edison's labours have evolved. Mr. D. J. Smith, another participant in the discussion, expressed disappointment at the author of the paper bestowing so little notice on electrical vehicles, particularly those on the petrol-electric system. An interesting announcement by this speaker was that he has been informed that, running over the same road, with approximately similar loads and at the same time, the petrol consumption on the Tilling-Stevens omnibuses is practically no more than with petrol vehicles. Mr. C. Crompton also put in a claim for the electric vehicle, alluding particularly to the McFarlane-Burge transmission, a regenerative system, which was described about a year ago to the members of the Institution of Electrical Engineers. In London a company are supplying commercial vehicles as rapidly as the Edison batteries can be obtained, and it is satisfactory to note that Glasgow's city electrical engineer has acquired an electric vehicle for the use of the department. Tramway undertakings also afford scope for the use of such a conveyance in the form of tower wagons: and we look forward to the time when many tramway generating stations will find profitable business in supplying energy for charging the batteries of motor cars of all kinds.

NEW TYPE OF LONDON GENERAL OMNIBUS BODY.

The London General Omnibus Company are experimenting with a new type of body, with rounded sides, which allow of a larger and more comfortable interior Most of the seats face the direction in which the vehicle is going, so that persons moving in and out do not trample on one's feet. Since the adoption of the "B" type, two and a half years ago, the company, at their works at Walthamstow, have built 2,300 of these vehicles, and they are still turning them out at the rate of 30 a week. Their mileage amounts to nearly two million per week, and breakdowns are very rare. In November last the vehicles ran 99¾ per cent. of their proper mileage; and as a general thing they only lose ·25 per cent. of the allocated mileage through mishaps. Some of the largest depots—Willesden, Cricklewood, Leyton, and Holloway—frequently complete a week's running without losing a single mile through involuntary stoppages. The whole of these 'buses undergo a thorough examination weekly, and are given a day in the shed once a fortnight for overhaul by the engineering staff.

MOTOR OMNIBUSES AT KEIGHLEY.

The motor omnibus department of the Keighley Council for the year ended March 31 last shows a heavy loss on the year's working. This is attributed to insufficient maintenance and failure to renew worn parts when required, previous to the employment of a competent motor mechanic. The year had, therefore, to bear the expenses of renewals which should have been charged in previous years. The total receipts were £5,628, an increase of £693, while the working expenses amounted to £6,563, an increase of £2,153. The following statistics are extracted from the report:

	1911-12.	1910-11.
Number of 'bus miles run ...	121,295	117,263
Number of passengers carried ...	682,330	625,632
Average number of passengers per 'bus-mile ...	5·625	5·335
Average number of passengers per 'bus journey ...	36·613	28·450
Number of gallons of petrol consumed ...	29,007	24,266
Number of miles run per gallon of petrol consumed ...	4·181	4·832
Cost of petrol per 'bus mile ...	1·992d.	1·624d.
Percentage of working expenses to receipts ...	116·61	—
Average traffic revenue per 'bus-mile ...	11·062d.	10·043d.
Average total revenue per 'bus-mile ...	11·136d.	10·101d.
Average working expenses per 'bus-mile (including cost of petrol)	12·987d.	9·026d.
Average working expenses per 'bus-mile (excluding cost of petrol)	10·995d.	7·402d.

MOTOR TANK WAGONS FOR PETROLEUM.

The final report was issued on March 18 of the Departmental Committee appointed in 1908 to inquire into the regulations relating to the storage, use, and conveyance of petroleum spirit. In their interim report the committee recommended that all road tank wagons for conveying petroleum spirit should be horse-drawn only. They now state that it is doubtful whether the prohibition of motor tank wagons could be now upheld in view of the continual improvements, and of the increasing necessity for facilitating the transport of motor spirits. The committee's principal recommendations are that direct Government control should be exercised in such a way that it may be possible for general rules to be made by the central authority prescribing general principles for guarding against dangers, and that officers be appointed to supervise the working of the Acts. The responsibilities of local authorities under the Acts are not to be diminished. Among other proposals the committee recommend that it should be made illegal to allow any petroleum spirit to escape into an inlet or drain communicating with a sewer. The committee consider that although the present two-gallon can for the conveyance of spirit is, on the whole, a satisfactory vessel, greater precautions for the maintenance of the cans in a proper state are necessary, and a new form of cap, incapable of being unscrewed by using the bottom edge of another can, should be devised.

Experimental Omnibus Service Advocated.—At the March meeting of Sheffield City Council, Councillor Kaye asked Sir William Clegg to take back the Tramway Committee's proposal to establish a connecting line from the present Hillsborough route up Albert Terrace Road to Crookes Valley Road, near Harcourt Road, and first to try the experiment of a motor 'bus on the route. Sir William Clegg agreed to take the recommendation back for a month, but made no further promise. He did not know whether it was feasible for motor 'buses to be run in that direction.

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MOTOR TRAFFIC.

MOTOR OMNIBUSES FOR GATESHEAD.

The Gateshead Tramways Company, in response to applications which have been received from time to time from local authorities in districts adjoining those served by the tramways, have decided to inaugurate a motor omnibus service at once between Low Felling and Chester-le-Street, and if this service proves to be the success anticipated, to give similar services between Felling and Washington and other districts. For the Low Felling and Chester-le-Street services nine omnibuses have been purchased, and, as will be seen by our

Straker-Squire 34-Seat Double-Deck 'Bus.

illustrations, these comprise both the single and double deck type; in both cases, however, the seating accommodation is the same, viz., for 34 passengers.

All the vehicles were supplied by Sidney Straker and Squire, Limited, the chassis being identical with the exception that the frames of the single-deck 'buses have extension pieces fitted to carry the longer body.

The Gateshead omnibuses represent the latest type of the Straker-Squire models, and are the outcome of the many years' experience which the firm have had with public service vehicles. They are constructed in conformity with the requirements of the London Police Authorities in regard to weight, silence, and mobility. The chassis is the company's new "C.O." type, specially designed for public service vehicles, the chief features of which are as follow: Constructed for load of 3 tons, the frame is made up entirely of pressed steel; length over all, 19 ft. 6½ in.; width over all, 7 ft. 1¾ in.; wheel base, 13 ft. 6 in.; wheel gauge, 5 ft. 9 in.

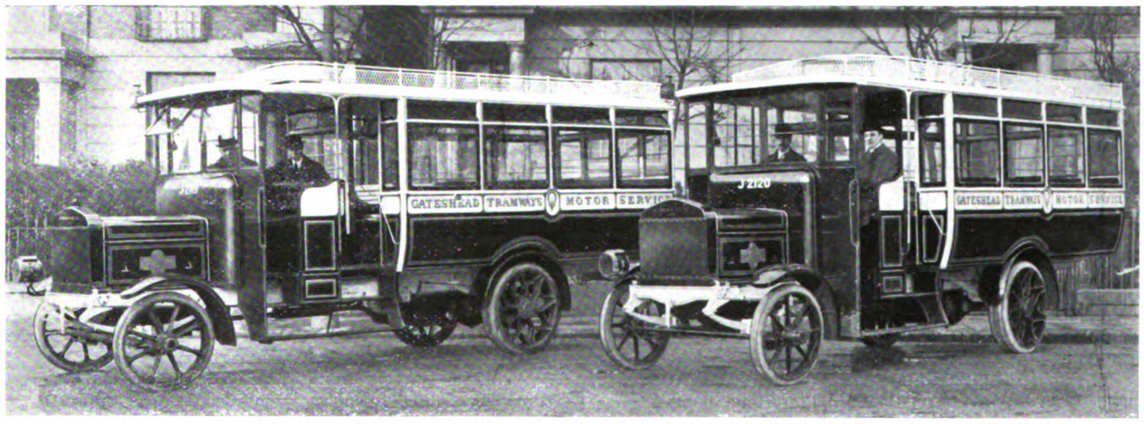
The engine is of the 4-cylinder type, with the cylinders cast in pairs, 4¼ in. bore by 5 in. stroke, and rated as 28·8 H.P. The inlet and exhaust valves are all on one side, they are operated by one cam shaft, and are interchangeable. The crank shaft, which is of high tensile steel, has three bearings, and the crank case is so arranged that the bottom portion can be dropped without interfering with the crank shaft bearings. An efficient automatic system of lubrication is maintained by an oil-pump driven by spur gearing from the cam shaft, troughs cast in the bottom half of the crank case being kept at a constant level serve the big ends, while the splash gives the necessary lubrication for the other parts of the engine. Bosch high-tension magneto is fitted; this is placed in a most accessible position on the opposite side of the engine to the valve gear. Thermo-syphon water circulation in conjunction with a radiator of the gilled type provides an efficient cooling system; vanes on the periphery of the fly-wheel act as a fan for the purpose of drawing the air through the radiator. The gear box is of the silent chain-driven type, giving three speeds forward and one reverse, with a direct drive on top speed. The change is by means of a single lever working in a gate. Two brakes are provided, the foot brake arranged on a drum on the gear box shaft being of the external double-grip type, and the hand brake of the expanding type acting inside drums on the road wheels. The transmission from the change speed gear box to back axle is by cardan shaft and worm gearing. The road wheels rotate upon the stationary axle forging at the ends of tubular arms, the drive being transmitted through two shafts direct to the wheels; it will be seen, therefore, that the shafts do the driving only, and carry no portion of the weight of the vehicle and its load. The differential is of the bevel type. Ball bearings are fitted to all the back axle bearings. The wheels are of cast steel of standard size, the front being fitted with "Timkin" roller bearings, and the back wheels with plain floating bronze bushes.

Messrs. Straker and Squire are just delivering a fleet of chars-a-bancs with chassis of the same type for service in Peterborough. The makers give the following figures as being the approximate cost per mile of their omnibus to seat 34 passengers:

Driver, conductor, and inspector	2·08d.
Petrol	1·28d.
Oil and grease	·15d.
Lighting	·11d.
Insurance	·22d.
Repairs (chassis and body)	1·17d.
Tyres	1·00d.
Depreciation	1·50d.
	7·51d.

ROAD CONFERENCE AND EXHIBITION.

It is expected that representatives of between 2,000 and 3,000 highway authorities from all parts of the world will attend the International Road Conference and Exhibition to be held in London in June next. The exhibition will be held in the Royal Horticultural Hall, Vincent Square, Victoria Street, S.W., and will be opened on June 23 by Earl Beauchamp, First Commissioner of H.M. Office of Works, president of the Exhibition Committee, and it will remain open until June 28. The exhibition will comprise road materials, appliances, and machinery used for the construction, maintenance, and improvement of roads, heavy machinery being staged on a piece of ground adjoining the hall. This area will be covered in, and paved with wooden sleepers. Sir Maurice Fitzmaurice, late engineer to the London County Council, is one of the members of the Exhibition Committee, and the hon. secretary is Mr. Maybury, county surveyor of Kent.



Straker-Squire 34-Seat Single-Deck Omnibuses

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MOTOR TRAFFIC.

STOCKPORT TROLLEY OMNIBUS SERVICE.

The Bremen system for which powers were obtained last session by the Stockport Corporation was opened for service on March 10 by the Deputy Mayor (Ald. Briggs), and has attracted much local and general interest. The route is a little short of two miles in length, starting from St. Peter's Square, in the centre of the town, and ending at the borough boundary at Offerton. The original intention was to carry the installation as far as Marple, but the Hazel Grove Council did not accept the terms offered by the Corporation.

The undertaking presents numerous features of special interest, as it is the first in this country equipped with a flexible trolley connection, the advantage claimed for which is that one pair of wires is sufficient for vehicles travelling in either direction, the current collector gear being unhooked and exchanged by drivers coming in opposite direction, at any convenient meeting place.

The Bremen system of current collection has been adopted, the two wires being erected in perpendicular parallel, the upper or negative wire therefore serving as the guard wire if necessary.

Another special feature of the system is the adoption of lattice steel poles, which are uncommon in this country. Mr. Lomax, the city electrical engineer, has himself superintended the contract for the overhead work, which has been carried out by the Corporation's own staff.

The vehicles have been supplied by the Brush Electrical Engineering Company, and they in their turn have some element of novelty. For example, the change speed control system is operated entirely by pedal action, leaving both hands of the driver free for steering purposes; otherwise, the chassis of the vehicle embodies a good deal that has been standardised in motor omnibus practice. A single 35-H.P. interpole motor is employed, and in most respects the vehicle is similar to the best types of petrol-electric motor omnibuses, substituting for the engine and dynamo the current collector device which enables the use of central station current.

After the opening run to Offerton and back, Alderman Sharples, chairman of the Tramways Committee, entertained the Deputy Mayor and a numerous company to tea, including the following members of the Tramways Committee: Alderman W. E. Hamnett (vice-chairman), Alderman G. Leigh, J.P., Councillors J. W. Booth, T. Brown, W. Hewitt, W. H. Hollis, J.P., A. Laing, Wm. Merrison, A. W. Painter, and T. T. Sykes, J.P. There were also present the borough surveyor (Mr. J. Atkinson), the deputy borough surveyor (Mr. Ward), the electrical engineer (Mr. Lomax), the tramways manager (Mr. A. E. Eardley), the committee clerk (Mr. G. Carter), and Mr. Bolton, of the Brush Engineering Company.

The Deputy Mayor, in proposing the toast of the Corporation and the Tramways Committee, said that nothing had been too laborious for the chairman of the committee to do, and together with those who were associated with him on the committee, he had made the tramway undertaking a great success. He thought the new system they had inaugurated that day was an example of the foresight and enterprise of the committee. He hoped that the adjoining authorities would in time allow the cars to run through their districts, so that there might be communication between one district and another.

Alderman Sharples, in reply, stated that as a member of the Assessment Committee witnessing the constant reduction in the value of property in the Offerton district, he was convinced that it was necessary to adopt some means of conveyance for that locality. An estimate was got out for tramway traction amounting to £14,000 for the initial cost, and that amount combined with the difficulty of the engineering question led them to turn their minds to the new system that was introduced at Bradford and Leeds. The committee visited those districts and came to the conclusion that a similar system was applicable to Offerton after the roads had been made suitable. It was to their credit, he thought, that they had installed a system which was the first of its kind in this country. Their engineer visited Germany and obtained the fullest information and the most reliable technical details as to enable them to proceed with confidence, and in the belief that the system would give satisfaction. The ordinary tramway would have cost £14,000, and they could not have obtained satisfactory running, as they could only have had a single loop line. On the system they had adopted, they had incurred in expenditure the sum of £8,000, including £4,000 for the laying down of the roads, and they were in the unique position of being able to take the money out of their reserves without danger to their future responsibilities, and so they could present to the ratepayers a system of traction free of charge so far as they were concerned. The committee had been well served by the electrical engineer, the tramway manager, the borough surveyor, the deputy borough surveyor, and the town clerk, and he might add the committee appreciated the efforts of the contractors, the Brush Company, who had done everything in their power to give satisfaction.

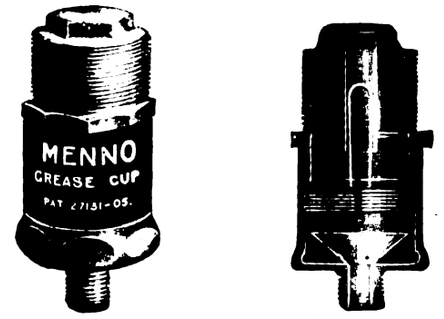
Alderman Leigh, and the officials already mentioned, also spoke, and Mr. Bolton, of the Brush Company, remarked that a large number of engineers and representatives of Corporations desired to see the cars running, and the company hoped to receive many orders as the result.

THE MENNO GREASE CUP.

Perfect lubrication without waste of grease is the claim made on behalf of a new grease cup which has recently been placed upon the market by Lubricators, Limited, Tollington Park, London. The principle upon which the lubrication is effected is totally different to the usual practice, as the method of operation is by compressed air. This air pressure insures a regular supply of grease to the journal at the exact speed and the exact quantity required, being regulated by the drawing action of the journal itself.

As will be seen in the illustrations, the cup consists of an upper and lower chamber, the upper containing a thin steel disc or float, and the lower a funnel through which the grease passes to the journal.

Each of these chambers are pressed solid from sheet steel or brass; the top has an external thread and screws into the bottom. The disc is attached to a wire guide which has a free vertical movement in a small tube. The method of operation is as follows: The lower half



External View. Cross Section.

The Menno Grease Cup.

or cup proper is fixed into position on the bearing by a screwed nipple, and then filled with grease. The top is then placed in position with the disc laying on the grease and screwed down for a quarter of an inch, the lock-nut shown in the illustrations being screwed down to the top of the cup. As the top actually enters the grease it will be seen that the cup is perfectly air tight, and that the action of screwing the top down causes a cushion of compressed air to be formed, so that when the machinery starts the cup will at once commence feeding without further attention.

Many advantages are claimed for the "Menno" grease cup, chief amongst these being the fact that grease does not harden under air pressure, and that very little attention is necessary to keep up the flow of grease. On a troublesome bearing it is said to require adjustment once or twice a week, but on ordinary bearing where speeds are normal, adjustment once a month suffices.

Openings for Motor Lorries in Brazil. Scope exists for introducing motor lorries into the well-paved town of Sao Paulo, as the climate is unsuitable for horses, and fodder for mules is expensive, the supply having to be imported.

Omnibus Service for Greenock.—In their annual report the directors of the Greenock Tramways Company intimate that they intend in the early part of the present year to inaugurate a motor omnibus service in Greenock.

A Rotherham Development.—Following trial rides in Tilling-Stevens and Daimler omnibuses, the Rotherham Tramways Committee have decided to institute a service of motor omnibuses to Thorpe in a very short time.

An Appreciated Omnibus Service.—To meet the demands of the public, the Great Western Railway Company have established a motor 'bus service between Neath and Pontardawe, and the Pontardawe Council are approaching the company asking them to extend the service to Gwauncaegurwen and Ystalyfera.

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MOTOR TRAFFIC.

Bremen Current Collector, Brush Car, and Lattice Standards.

Exchanging Current Collectors at a Stopping Place.

TROLLEY OMNIBUS SERVICE AT STOCKPORT.

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MOTOR TRAFFIC.

AIRLESS RESILIENT WHEELS.

The fact that some hundreds of letters patents have been taken out during the past few years, and that large sums of money have been expended with the object of obtaining a reliable resilient wheel, can be taken as good evidence of the demand for a system that will give the advantages of the pneumatic tyre without its defects and without its cost of maintenance. Unfortunately for the inventors and those financially interested, the majority of these devices have failed when put to the practical test. A few appear to have met with some degree of success, inasmuch as they have been able to absorb the road shocks, but, as in most instances, this has been accompanied by loss of power, the net result can only be regarded as unsatisfactory. Under these

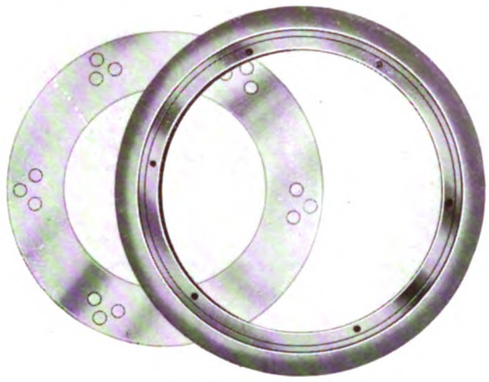

Fig. 1.—The Rim.

circumstances, it is interesting to note the excellent performance of the airless resilient wheel, which is now being manufactured by the Airless Resilient Wheels, Limited, of Albion Street, London, N.

After 12 months' continuous service these wheels do appear to justify the makers' claim that it is an improvement upon the pneumatic tyre. Following exhaustive tests, which were carried out privately, a set of the wheels were supplied to Maple and Company, and these have run over 14,000 miles without any attention. The tyres on this particular vehicle when running on non-resilient wheels covered no more than eight to nine thousand miles, a fact which, apart from the general advantage to the machine, shows a great increase on tyre mileage, and consequent reduction in cost of upkeep for the resilient type of wheel.

The airless resilient wheel consists of two parts—the centre wheel and a floating rim. The rim (Fig. 1) is made up of the band tyre, a

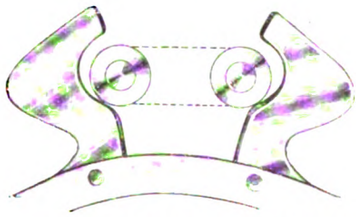

Fig. 2.—Projection to Hold a Telescopic Sleeve.

channel shaped like the lower half of the letter H, and two deep circular plates. The channel is attached to the inside of the steel band on which the rubber tread is built up, and a guard plate is fastened on each side of the channel and supports the outer rim. The steel band and channel can be made in one piece. The centre part of the wheel is of the ordinary pattern, with the tread or sole fitted with a steel channel in the shape of the upper half of the letter H. To this channel is fitted a series of projections fashioned like the head and neck of a duck; these are pivoted at the end of the neck, and are arranged in pairs facing one another (Fig. 2). The crest of each head is linked to one another with a telescopic sleeve, which carries a helical spring (Fig. 3), and in between each pair of projections are placed a pair of twin rollers or distance pieces. The rollers are secured to the side plates by steel bolts passing through from side to side. Each pair of projections is at an equal distance apart, and the springs are of equal length and strength. The guard plates of the floating rim overlap, and are free to slide on each side of the centre wheel. By this arrangement any sudden jerk or movement of the outer or floating rim operates through the twin rollers, and tends to force each of the projections to turn on its pivot and away from its corresponding roller, thereby putting all the springs under compression equally and simultaneously. Fig. 4 shows the springs in position.

The weight of the vehicle is thus distributed over all the springs, and whatever obstruction the rim may meet, equal transmission of the driving force is assured as the movements of the projections and springs are entirely sympathetic. All the parts work in grease and the guard plates have dust and water-tight joints. The sleeves, projections and rollers are made of special steel, and are practically unbreakable; they can be made to carry any weight and to withstand any strain, lateral or otherwise. The springs are tempered to give the maximum of resiliency, and being in spiral form would continue to be of service even if broken, but as their action is a natural one it is obvious that their durability is great. A unique feature of the airless resilient wheel is the fact that one set of wheels can be adapted to carry either two or four tons with

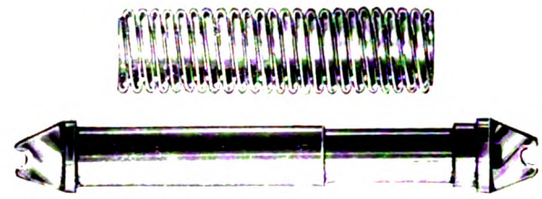

Fig. 3.—Telescopic Sleeve and Helical Spring.

the same maximum of resiliency, this adaptability being secured by the standardisation of the parts with interchangable springs, the insertion of springs of the required strength being all that is necessary to effect the change. In effect this resilient wheel is somewhat similar to the pneumatic, as in both cases shocks are transmitted to every part of the rim of the wheel. In the case of this invention, the dangers of tyre bursts and punctures are entirely eliminated, and the driving power is transmitted through a series of springs, thereby easing the strain of the whole of the mechanism of the car. Therefore the advantages of the new system for industrial and public services, where durability and reliability are of the utmost importance, are such as

Fig. 4.—The Springs in Position.

should commend it to the careful attention of all those responsible for the maintenance of such services. A considerable number of airless resilient wheels are now in service, amongst the latest well-known firms to fit them being the London and Provincial Motor Carriers, Limited, Messrs. Selfridge and Company, and Messrs. J. Lyons. Wheels are also being manufactured for 2, 3, 4, and 5-ton lorries.

THE COMPETITION AT CROYDON.—Commenting on the competition of the two lines of London motor omnibuses running through Croydon and the tramways, a writer in a local newspaper asks: "Why is it that the omnibuses are full while the tramcars are by no means so liberally patronised? In the centre of the town the reason of the public's preference is easily understood. No one who wishes to get quickly from West Croydon Station to the Greyhound or the Swan would hesitate in his choice. On the route where there is a double track the advantage in speed is not so noticeable, yet the same disparity in patronage is observable."

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MOTOR TRAFFIC.

GARRETT SUPERHEATED STEAM WAGONS.

The introduction of the process of superheating of steam by Richard Garrett and Sons, Limited, for their wagons, combined with the use of the rubber tyre, has served to place the steam road vehicle in the front rank of heavy motors as regards speed and economy of working.

Garrett Superheated Steam Wagon.

At the recent Manchester Commercial Motor Exhibition the single 3-ton superheated steam wagon, fitted with Polack solid rubber tyres, attracted great attention at the stand managed by Mr. C. E. Holden, the local representative of Richard Garrett and Sons, Limited, of London, and St. Stephen's House, Westminster, S.W. This attractive exhibit had been disposed of before the show, a not surprising circumstance in view of the records which the makers can claim for both their 3 and 5-ton types.

Test runs were carried out with the two types in 1911 and 1912 by the "Commercial Motor" inspection and trial department, whose certificates indicate that the results achieved on the second occasion were so great an improvement as to constitute a record in coal and water consumption. Both trials began from the firm's works in Suffolk, and the run was to Lowestoft and back, a distance of over 48 miles. In 1911 a 3-ton vehicle, having a weight of five tons in running order, was tested, and in 1912 a 5-ton machine underwent the trial. As both

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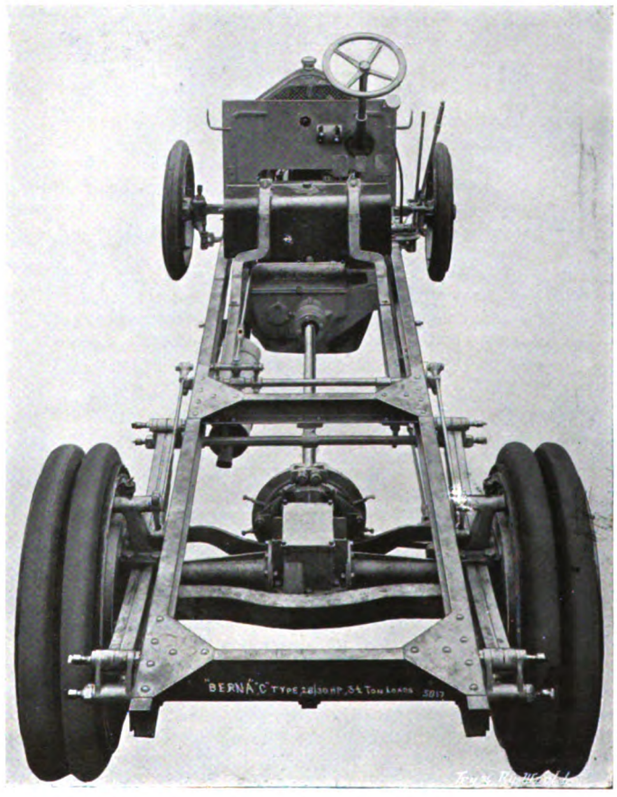

Berna 3½-Ton Chassis. Rear View Showing Differential and General Arrangement.

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MOTOR TRAFFIC.

were fitted with rubber tyres they came under the 12 miles an hour speed limit, but each was capable of exceeding that figure.

An idea of the improvement which the firm has effected in their vehicles during the interval between the two trials will be apparent when mention is made that whereas in 1911 the amount of coal consumed per net ton-mile was 1·18 lb., in 1912 the consumption was only ·925 lb. per net ton-mile. On the first occasion the water consumption was 8·07 per net ton-mile; at the second trial it fell to 6·64 lb.

Two improvements were chiefly responsible for the remarkable difference in the results. One was in the fitting of specially designed piston valves; the other was a new type of superheater. The engine is of the compound type, and is situated above the boiler, which is of the locomotive type, for which the firm are renowned. The bore of the high-pressure cylinder is 4 in., that of the low pressure 6¾ in.; stroke, 7 in.; grate area, 25 sq. ft.; total heating surface, 90 sq. ft.; working pressure, 200 lb. per sq. in.; tubes, 53 of 1¾ in.; engine speed, 400 revolutions. Garrett's patent corrugated fire box, superheater and feed-heater, were fitted, together with single chain drive to live axle. The gross weight was 11 tons 15 cwt., including a load of 5 tons 4 cwt. of pig iron. In a trial which extended over 7 hours 27 minutes the stops aggregated 2 hours 27 minutes. The average speed was 9·8 miles per hour, and the net running time was 5 hours 3 minutes. The quantity of coal used was 240 lb. (exclusive of that required for steam raising before the trial), and water 1,720 lb., the total mileage being 49·59. Evaporation amounted to 7·16. Ease of control and steering were marked features of the wagon.

Our illustration shows both the 3 and 5-ton wagons on rubber tyres which have been in regular service since March 1, 1912, for Showell's Brewery Company, Birmingham. Messrs. Garrett have recently received a report upon the working of these machines, and, judging from the following extract, there appears to be very little doubt as to the economy and reliability of the Garrett superheated system:

"We are much impressed with the ease with which the wagons ascend even the steepest hills with full load, and we presume this is due partly to the superheater and special valve gear increasing the effective power of the engine, and partly to the special improved type of locomotive boiler with corrugated fire box, which appears to add greatly to the steaming qualities of the boiler, as we have never seen one of these boilers fail the engine. The smooth and quiet running and the great ease with which the wagons are handled even in the thickest traffic of our city are most satisfactory."

MOTOR TRAFFIC NOTES.

Industrial Electric Vehicles.—An addition has to be recorded to the number of companies engaged in the manufacture of electric road motor vehicles in the United States. It is the Edison Electric Vehicle Company of America, with headquarters at Lawrence, Mass. The company are building industrial vehicles, fitted with Edison batteries.

Fuel at Sixpence per Gallon.—The Standard Petroleum Carburetter (Parent) Company, Limited, states that they have made arrangements with a large firm of oil refiners to supply a fuel suitable for use with the company's carburetters at 6d. per gallon, and in any quantity. The refiners are at present prepared to supply 500,000 gallons for immediate delivery. Cars running on this fuel may be seen outside the offices of the company at 171, Queen Victoria Street, E.C.

British Motor Manufacturers' Enterprise.—At the recent automobile exhibition held in Toronto, the British Society of Motor Manufacturers and Traders had a representative in attendance. At present, Canada obtains the bulk of her cars from the United States, largely owing to the fact that the American makers cater to the exact needs of Canadian users. During 1912, 5,629 United States cars of the value of $6,000,000 were imported, and only 321 from Great Britain of the value of $340,000.

Liverpool Tramways Motor Omnibuses.—The two petrol-electric motor omnibuses by Tilling-Stevens, Limited, which made the journey from London in December, have proved a welcome addition to Liverpool Corporation's motor omnibus fleet. They are running excellently, and are giving great satisfaction. The omnibuses run from Woolton Village to Calderstones Park, where they connect with the tramways to the city, and through tickets are issued. An extension of the service took place on March 20.

Avon India Rubber Company.—The new catalogue of this company contains much information of use to managers of transport undertakings and of car works. Over one thousand different sections of solid rubber tyres are manufactured at the works at Melksham, Wiltshire, and amongst several other departments is one devoted to making india rubber goods for coachbuilders. The London depot is at 19, Newman Street, Oxford Street, W., and branches are established at Birmingham, Manchester, Glasgow, and Bristol.

Motor Vehicles Wanted for New Zealand.—The Government of New Zealand at the end of January dispatched an expert to the United Kingdom and Europe with a view to selecting types of motor vehicles best suited for lighter work throughout the Dominion. Four years' ago the same delegate made a similar tour in respect to securing heavy motor lorries for the conveyance of mail matter. In consequence of his report, the Post Office then adopted motor traction. Four companies, with an aggregate capital of £31,500, have recently been formed in New Zealand to exploit the possibilities of motor services. A municipal service of motor omnibuses has been proposed for Timaru.

Stepney Council and a Motor Omnibus Service.—Some time ago the London County Council promised to experiment with petrol-electric tramcars on the Burdett Road and Grove Road horse tramways. Owing to delay in carrying out the trials, Councillor Larnder gave notice of a motion for the March meeting of Stepney Borough Council to invite the Omnibus Company to supply a motor omnibus service on the route, but prior to the meeting a letter was received from Mr. C. Jackson, the leader of the Municipal Reformers on the County Council, stating that the trials of the petrol cars would take place within a fortnight. A request made by Councillor Larnder to be allowed to withdraw his motion was opposed by the Progressives, whereupon the Municipal Reformers left the chamber, the meeting consequently having to be adjourned.

Commercial Motor Users' Association.—The annual report of the Commercial Motor Users' Association shows the increase in membership during 1912 to be 320 members. The association has been successful in negotiating a modification of Motor Cars (Use and Construction) Order, 1904, under which the Local Government Board contemplate approving the use of a reversible steam engine in industrial vehicles as a brake. Arrangements are in hand for the organisation of night shelters along the Great North Road, and branches; Holyhead Road, with extensions to Lancashire towns; Bath Road; Portsmouth Road; Folkestone-Dover Road; Bournemouth Road; Yarmouth Road; and Gloucester Road. The seventh annual parade of motor vans and motor lorries will take place on Whit-Monday, May 27, in London, and is again under the patronage of H.M. The King.

London and South Western Railway Company's Bill.—Mr. W. Bishop, solicitor to the London and South Western Railway Company, has written to the local authorities who propose to oppose the company's application for road motor powers, offering to substitute modified provisions similar to those contained in the London and North Western Railway Act, 1909, on the undertaking that all opposition is withdrawn. The new clause would only authorise vehicles for passengers and their luggage to and from the railway, and the local authorities' power of licensing would not be unfettered, but be subject to appeal to the Board of Trade. The Parliamentary agents to the Surrey local authorities have advised the latter that it is doubtful, in view of the statutory power which the proposed clause would confer on the company, whether any claim could successfully be made for damage to roads by extraordinary traffic.

Tilling-Stevens, Limited, and Hastings Sea Front.—Hastings and District Tramways Company having applied for Parliamentary powers to substitute the overhead for the Dolter surface-contact system of tramways on the sea front, W. A. Stevens, Limited, 26, Victoria Street, London, S.W., recently demonstrated the capabilities of their petrol-electric omnibus to the Mayor and Corporation of Hastings. The vehicle not only took the members of the Council for a run along the smooth wood paved esplanade roadway, but through the narrow winding streets of the old town as well. Mr. R. Ferguson, the borough electrical engineer, who was one of the party, remarked "The body can be improved, but the chassis is splendid; perfect control, and quite simple." At the Town Hall the Mayor complimented Mr. Stevens on the vehicle, and said the Corporation were anxious to do all they could for the Tramways Company, for they deeply regretted the difficulties of the front line problem. He advised Mr. Stevens to consult with the Tramways Company. Dr. Gray remarked that the frontagers were practically solid in asking for something of this sort. It would not only solve the front line problem but the old town difficulty, which could scarcely be done by a tramway. It would provide an efficient old town service and link up the outer circle. Mr. Stevens, in reply, said he had decided to meet the Tramways Company in any manner possible. He would be willing to supply them either with the chassis or with complete vehicles. As an alternative, he would supply the cars and work the road and share the profits. He gave particulars of the different kinds of cars his company were supplying to various towns, some being single-deck, some double-deck, and some open; others being opened in front and closed in wet weather.

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A REVIEW OF CURRENT PROGRESS IN ELECTRIC AND OTHER TRACTION

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BRADFORD CITY TRAMWAYS PARCEL DEPARTMENT.

BY C. J. SPENCER, A.M.I.E.E. *(General Manager, Bradford City Tramways).*

The question as to whether a tramway undertaking ought or ought not to confine its activities to the carrying of passengers has formed the subject of a good many discussions in tramway circles, and on more than one occasion has appeared worthy of consideration in various presidential addresses read before the Tramways Associations. It almost seems *prima facie* true that a tramway system could serve the public with considerable advantage by using its plant to carry, in addition to passengers, goods in some form or other.

In most Parliamentary Acts for tramways, full powers have been obtained for the carriage of parcels, goods, minerals, etc., but not much advantage has been taken of these powers. On several systems, however, goods carrying on a small scale is actually in operation, but is, in the main, confined to parcels. In the case of Bradford it cannot be said that this kind of work was any very novel departure on the part of the municipality.

Prior to the Corporation taking over the operation of the lines, two tramway companies were in existence, and they did a certain amount of parcel traffic, which, I believe, was to some extent remunerative to the companies, and certainly of some convenience to the public. The Corporation therefore, when taking over the tramways, were faced with two alternatives in connection with this parcel traffic, namely, either to abolish the parcel-carrying system entirely, or to continue and extend the system on rather more up-to-date methods than those adopted by the companies. It was eventually decided to adopt the latter course.

Transferring Parcels from Depot to Car.

The point of view of a municipality undertaking a

scheme of this sort is necessarily somewhat different from the point of view of a company. The first question that a company would address to itself on considering the adoption of a parcel-carrying business would be: "Will it be profitable and will the amount of profit be sufficient to make it worth while spending time and money in order to develop the business?" The point of view of the Corporation is generally: "Will it be a public convenience, and can it be done without incurring a loss?"

As a matter of fact in the case of the Bradford Corporation, the turnover and the profit is a very small proportion of the total turnover of the tramways business. Therefore if profit was the only consideration, it may be questionable whether the enterprise is worth the time and thought spent upon it, as compared with the financial results of the whole tramway undertaking. If, however, the question be asked whether the parcel-carrying business of the Bradford Corporation Tramways Department is a great public convenience or not, there can be but one answer, and that is in the affirmative. When it is remembered that for the year ending March 31, 1912, the department handled 645,914 parcels, and that in the year just finished 716,157 parcels were handled, an average of 13,772 parcels per week, there can be no question about the public usefulness, and appreciation of the service.

Both in Bradford and elsewhere this service has been severely attacked by various parcel-carrying agencies, on the ground that it was unfair competition with them, and that it was undesirable for a municipality to enter into a competitive business of this description. If it could be shown that private enterprise was capable with the means at its disposal of giving the same efficient service at the same (or cheaper) cost to the community, then it does seem that there might be something in the arguments of the private carrying concerns that would be worthy of careful consideration, but it must not be overlooked that no private trader could possibly have at his command the existing organisation of a quick service of cars in various directions running at frequent intervals, and it would therefore be impossible to serve the public need in this direction at anything like the cost, with the same frequency of deliveries and the same speed of transit.

On the other hand, it must be admitted that it would be very undesirable for a municipality to enter into a business of this description and incur a trade loss as a result, and all arrangements and organisation should undoubtedly be based on the underlying principle that no charge, either direct or indirect, should fall upon the ratepayer, apart from what he pays for services rendered in connection with the business.

Central Parcel Depot—Bradford City Tramways.

Before the Bradford Corporation embarked on this enterprise, a good deal of very valuable and useful information was collected by the Tramways Committee from other Corporations and company tramway undertakings who had already entered into this business. As a result a scheme was devised whereby it was possible for anyone having a place of business or a residence within half a mile of a tramway line operated by the Bradford Corporation to receive or send parcels at certain rates.

THE ORGANISATION.

A central receiving office is established in the centre of the city. As a matter of fact the basement of the central offices of the tramways department at Hall Ings is used for this purpose, where practically all parcels are received from all directions; these are checked,

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recorded, and forwarded to their destinations continuously. The whole of the tramway area is divided into districts, each district being served by a sub-office, receiving and despatching its parcels from a central depot throughout all the working hours of the day. Attached to each sub-office are one, two, or three boys, according to the magnitude of the business handled, who perambulate the district with handcarts, collecting and delivering parcels in the ordinary way.

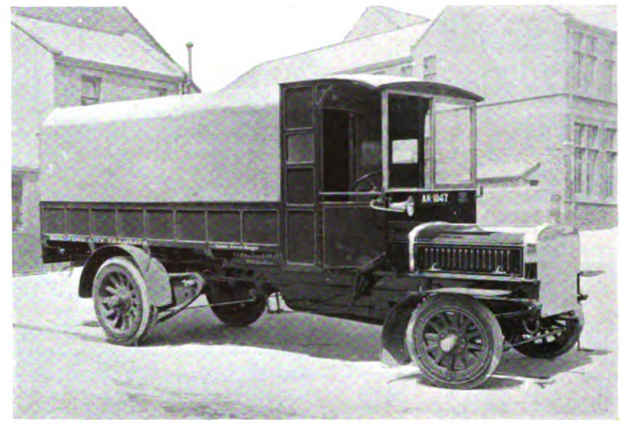
At the central receiving and despatching depot, each sub-office has its own particular bin into which parcels for that district are collected, and at certain scheduled times the bin is cleared; the parcels are packed into hampers or bags, and despatched in bulk by tramcar to the sub-office, and from there distributed as described. The basket or bag is taken by the parcel department employee to the tramcar running to the district, placed on the platform behind the driver, the car being met at the sub-office by another member of the same staff, so that no handling is necessary on the part of the passenger staff.

Inward parcels, however, can be handed by the public to the conductor of a car going into the city, who receives with the parcel (if not already stamped) the amount payable, and who in turn hands over the parcel together with the payments to the parcel staff, who meet all inward cars at the city termini throughout the day.

On very busy systems this might be an undesirable practice, as it might be taken, generally speaking, that conductors have quite enough to do to look after passengers without having to bother in any way with parcels. As a matter of experience, however, we find that on the Bradford system the magnitude of this traffic, viz., individual parcels handed to conductors by members of the public, is very small in proportion to the total traffic, and the arrangement works very well.

A very large business is done in connection with both wholesale and retail houses in the town who are constantly sending out parcels to their customers. In these cases the firms purchase from the department at a discount rate fairly large quantities of contract tickets with the name of the firm printed on the ticket. These parcels are collected by means of a van constantly perambulating round the shopping centres of the town, and are brought to the central receiving office and from there despatched in the ordinary way to the various districts.

Necessarily some efficient system of checking each individual parcel must be in operation, as in the case of a claim being made for lost or damaged parcels. Copies of the waybills and forms adopted for this purpose are here reproduced.



Motor Parcel Vans Carrying Meals for School Children—Bradford City Tramways.

Parcel Truck Awaiting Arrival of Car.

District Parcel Office.

MUNICIPAL USES OF THE SYSTEM.

In addition to the ordinary parcel carrying business the parcel department is doing a large business for the Education Committee, who, under the Education School Meals Act, are feeding 2,000 school children daily at the various schools. The meals are cooked at a central kitchen, and are despatched to the various schools *via* the parcel department daily. A portion of this traffic is taken specially by tramcar, but the bulk is handled exclusively by two large motor vans built for the purpose. The work is done at net cost, and

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BRADFORD CITY TRAMWAYS.

B.C.T.
PARCELS
1d.
TICKET
B 70204

PARCEL WAYBILL from BRADFORD to .....

.....day of .....19 Despatch.....

Description.	CONSIGNEE.	ADDRESS.	Weight. lbs.	To Pay.	Paid Stamp.	SENDER'S NAME.

NOTE. This Waybill must be examined on Receipt by Agent in charge at Receiving Depôt, who must see that Parcels received by him correspond with the entries hereon, and any discrepancy immediately reported to Central Depôt, HALL INGS, NOT LATER THAN **9·0 a.m.** THE FOLLOWING MORNING.

P. 3146. 1000. [Actual size of form, 4¼ in. × 7¼ in.]

4324—200 (64a.)
B. C. T.
DELIVERY SHEET.
*Time*_____ **D**
Date *191*
Names:—

s.	d.

Depot Debit
No. of Parcels
Depot No.

BRADFORD CITY TRAMWAYS—PARCEL DELIVERY SHEET. D

Name of Messenger *Date*____

Time of Delivery.	NAME.	ADDRESS.	Number and Description.	WEIGHT. lbs.	PAID. s. d.	To pay at Destination.	Extra Delivery.	SIGNATURE.

in charge at Receiving Station.

Should this Sheet be lost a reward will be paid to the person returning same to Central Depot.

[Actual size of this form, 7½ in. by 16½ in.]

Bradford City Tramways.

PARCEL DEPARTMENT.

REPORT OF DAMAGE. *Pro. No.*

To Parcel Superintendent,
4, Leeds Road.

Date

TP 1464—2000 (150)

Claimant *£* : : *For*

Sender .....
Consignee .....
Date and Time of Way Bill .....
Weight of Parcel .....
Amount of Charges .....*O.R. or C.R.*.....
Date Delivered .....
Delivery Sheet No. .....
Signature .....
If any Remark .....

Date of Complaint .....
Description of Goods Claimed upon and .....
Invoice Price .....
Value of Salvage .....
How Packed .....
Is damage apparently a transit one? .....

Remarks:

Signed

[Over, if necessary.]

[Actual size of form, 8¼ in. × 10¾ in.]

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last year a sum of £1,596 was paid to the parcel department by the education department for services rendered.

The baths department of the Corporation also utilise the parcel department for the conveyance of clean towels from their central baths to district baths, and for the return of soiled towels through the same medium. The magnitude of this business is such that payment of £103 was made last year by the baths department for this service.

Considerable business is done with the street and drainage department in the handling of paving stones, cement, etc., by means of specially constructed vehicles running over the tram lines, and also by motor lorries, which whilst not being exactly parcel work is certainly in the direction of utilising an existing department and organisation for other municipal purposes, with considerable advantages to the departments concerned.

SECTION Wakefield Rd

Date 19/3/13

TIMES OF DESPATCH.

A.M.		Initials of Clerk.	Weather	P.M.		Initials of Clerk.	Weather
7	50	HB	Drizzy	1	15	TMG	fine
9	0	TMG	fine	2	15	TMG	"
9	30	TMG	Wet	3	0	TMG	"
10	20	TMG	fine	4	0	TMG	"
11	0	TMG	Wet	4	30	GF	fine
11	30	TMG	"	5	0	GF	
12	15	OB	"	5	30		"
				5	50	"	"
				6	0	"	
				6	15	"	

[Actual size of form, 5¼ in. by 8 in.]

181 544/18/3/13 DUPLICATE. 14937

Bradford City Tramways.

GOODS LEFT ON CAR.

Date Feb 10th 1913

Description Umbrella

If Purse, give Contents

Car No. 92 Time 8-20

Section Allerton

Handed in by Longbottom

Received by J Home

DUPLICATE TO BE ATTACHED TO WAY-BILL AND SENT TO THE OFFICE.

[Actual size of form, 3¾ in. by 4 in.]

Bradford City Tramways.

PARCELS DEPARTMENT.

Daily Returns to Central Depot.

Depot No......

Statement of Cash received on.....*day, the*.....*day of*.....*19*

	£	s.	d.
Stamps Sold	.....	.....	.....
Cash handed in by Messengers ...	.....	.....	.....
Other Carriage Collected ..	.....	.....	.....
....	.....	.....	.....
....	.....	.....	.....

Total Number of Parcels Delivered ... .

" " " *Collected* ... .

Signed.....

[Actual size of form 4½ in. by 8 in.]

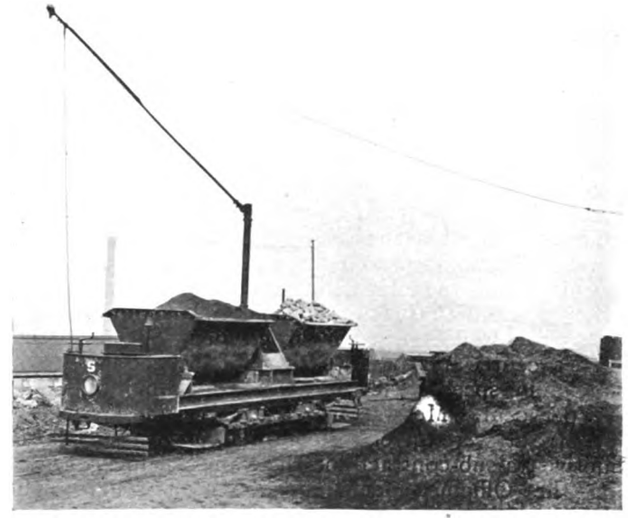
A good deal of business is also done with the farmers who forward by tramcar their milk for the city. Milk cans are placed on the car platforms by the farmer at the rural or suburban district, and are received by the milk dealers in the centre of the town. An average of 220 cans a week is now carried, and the revenue from this source in 1912 realised £280.

This department is also responsible for the care, registration, and disposal of lost and unclaimed property, and whilst the revenue from sales and cloak room fees will not much more than balance the cost of administration, it is a very necessary branch of a tramway department, and a great convenience to the absent-minded tramway passenger.

Through working arrangements with neighbouring tramway undertakings have been entered into, and an extensive business is now done in parcels between the towns of Halifax, Dewsbury, Batley, etc. For the shorter distances the rates for parcels vary from 2d. for 7 lb. up to 5d. for 56 lb. For what may be called the interurban work they range from 4d. to 8d.

For the year ending March 31, 1912, a net profit of £391 was made on the whole operations of this department.

The total staff of the department consists of 81, with a weekly wage list of £82. The majority of the members of the staff are youths ranging in age from 15 to 21. It is unfortunate that in the majority of cases, where boy labour is employed in unskilled business, the employment is an absolute blind alley. When a boy gets beyond a certain age, he is no longer of any use to his employer for the particular work for which he employed him as a boy, and he is turned adrift.



Motor Cars for Hauling Road Material—Bradford Tramways.

In the case of the tramway department, however, practically every boy is absorbed into the general staff of the department as he becomes old enough, so that the parcel department has gradually and automatically

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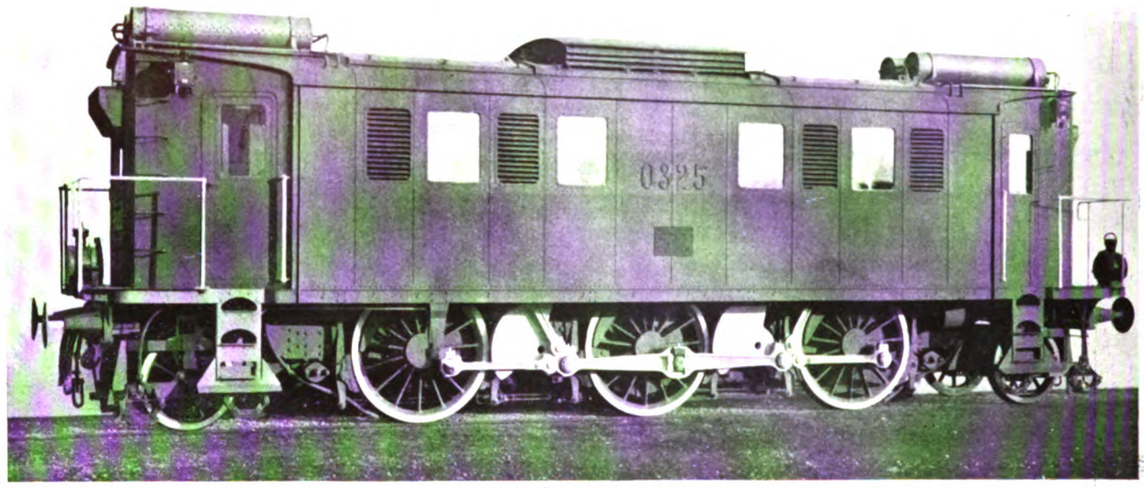
become a gateway for employment on the tramways, and as such has proved a very valuable adjunct to the tramway department. Provided every care is taken in the selection of boys, and the discipline is kept to a high pitch, the effect of this system should in the long run be excellent for the whole undertaking.

SIX COUPLED ELECTRIC LOCOMOTIVE OF THE ITALIAN STATE RAILWAYS.

NOVEL RUNNING GEAR WITH RADIAL AXLES.

The Milan-Varese line of the Italian State Railways has been worked since 1901 by electric traction on the third-rail system with single motor cars or with trains equipped on the multiple-unit system, two cars per train being provided with motors. Continuous current at a pressure of 600 volts is used, and speeds of 52 miles per hour are attained by express trains, while the local trains are run at an average speed of 40 miles per hour. The weight of these trains is respectively 90 and 136 tons. Owing to the growth of the traffic the number of trains has been increased from time to time, until the possible limit was reached some time ago. Recourse had therefore to be made to providing increased accommodation per train. It was decided to give preference to electric locomotives for the new equipment, for one reason, because they could be used to haul goods trains as well as passenger trains. It was specified that the new locomotives should be capable of working goods trains of 400 tons at a maximum speed of 25 to 28 miles per hour, up gradients not exceeding 2 per cent., and passenger trains of 200 tons at a maximum speed of 58 miles per hour, up gradients of 12 per cent. Messrs. Brown, Boveri, and Company, of Milan, were given a contract for five such locomotives, a sub-contract for the frames being executed by the Officine Mechaniche, also of Milan. The principal dimensions of the new locomotives are as follow: Total length of wheel base, 4 ft. 8 in.; diameter of driving wheels, 4 ft. 10 in.; diameter of pony wheels, 3 ft. 1½ in.; total weight, 78 tons; weight of part suspended on springs, 54·9 tons; adhesion weight, 46·8 tons; height of centre of gravity above rail, 5 ft. 5 in.; maximum tractive effort, 20,570 lb.

The new locomotives, as shown in the accompanying view and drawings, have six coupled wheels, and two trailing wheels at each end. Each trailing axle is connected with the two adjacent coupled wheels, and they form a bogie of the Italian type, that is, they swivel on a pin, and have lateral play. All coupled axles are so constructed as to allow lateral deviation, an arrangement now for the first time adopted for high-speed service. The position of the motors and other heavy parts of the equipment raise the centre of gravity to a point relatively high to the points of application of lateral pressure, which pressure is affected by the curvature of the track; for this reason power is transmitted by connecting rods working on to two auxiliary axles (one on each side of the central axle) coupled together by means of a straight rod, which carries the central axle crank-pin bearing. Two short coupling rods connect the two outer driving axles with the central axle. To allow free movement of the frame, relative to the axles, spherical crank pin joints are fitted to the two outer driving axles, as also to the big ends of the diagonal connecting rods, to allow of end play in the armatures. These spherical surfaces are machined on the seatings of the cylindrical pin journals. In regard to the auxiliary axles, attempts have been made to obviate the "pounding" action by rigidly interconnecting the motor and auxiliary-axle bearings, the one with the other; rigid connection is obtained by means of a cast-steel frame which carries the motors and is placed between the double frame. To these cast-steel frames and outside the double frames four cast-steel attachments are fitted, two for each double frame; these carry the auxiliary axle bearings. Special attention has been given to the lubrication of these bearings, an electric heater being fitted in each lubricator to guard against solidification of the lubricant in cold weather.



New Electric Locomotive of the Italian State Railways.

The body of the locomotive is in three intercommunicating sections, the two at the ends being designed for the driver, who can pass from one to the other without leaving the machine. The locomotives are equipped with two traction motors, which, when at full speed, run at 350 revolutions per minute. The equipment has been designed generally to keep the centre of gravity high, and to group the heavier weights as close as possible to the vertical axis of the locomotive. All subsidiary electrical apparatus for controlling the locomotive is placed in the central compartment, the two motors being placed one on either side.

The central compartment contains regulator, suspension springs, main automatic switch, motor reversing gear, switch for cutting out either motor, main valve,

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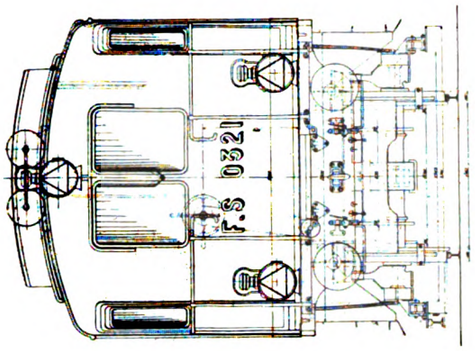
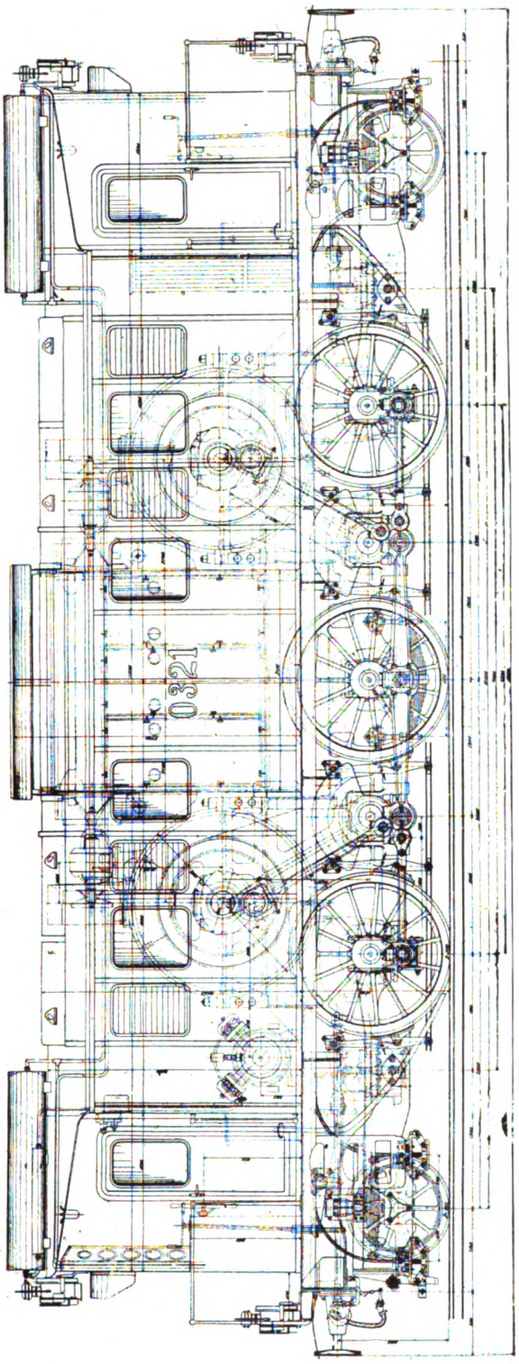
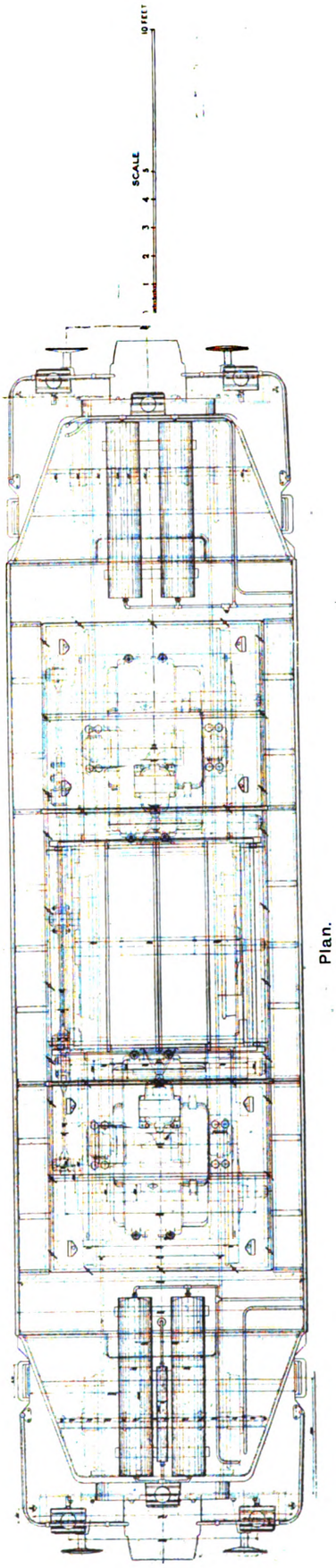


End Elevation.



Sectional Lateral Elevation.



Plan.

Six Coupled Electric Locomotive of the Italian State Railways.

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or auxiliary services, lightning arrester, automatic switch to regulate the electric train heating apparatus, ammeter connections, all ranged on either side for easy control and properly insulated. Each of the driver's cabins is fitted with large windows. The handles of the various apparatus for governing the engine are placed on the manœuvre board in front.

In the tests, trials were made with goods trains of 462 tons, inclusive of locomotive, 72 tons, when, on a 4 per mille. ascent, 37·8 miles per hour were made. The passenger train test was made with 270·5 tons, inclusive of locomotive, 72 tons. A maximum of 56·4 miles per hour was reached with a consumption of 26·5 kw. hours per ton-kilometre.

Starting tests were made with a train of about 200 tons on an almost constant 1 per cent. ascent, with curves of 1,650 ft. radius minimum, of 576 ft. to 594 ft. lengths, at speeds up to 43·5 miles per hour. After 20 such consecutive starts, the temperature of the electrical apparatus rose quickly, and there resulted a maximum temperature rise of about 37 deg. C. in the motors, and 67 deg. C. in the resistance, relatively to the temperature of the air, which was 12 deg. C.

The running of the locomotive has fully met expectations both in the traction of goods trains up 1·2 per cent. gradients, and with passenger trains at high speed, sometimes even exceeding 62 miles per hour, and without experiencing appreciable shocks on minimum radius curves at speeds of 43·5 miles to 49 miles per hour. For these particulars of this extremely interesting machine we are indebted to our excellent contemporary, the "Revista Technica delle Ferrovie Italiane," the monthly official organ of the Italian State Railways.

HEAVY ELECTRIC LOCOMOTIVES FOR THE NORTH EASTERN.

Mr. Vincent L. Raven, chief mechanical engineer of the North Eastern Railway, addressing the students at the Darlington Technical College on the occasion of the opening of a mechanical laboratory equipped with a steam engine and boiler, stated that at Darlington, practically in the same place where the first locomotive was started in this country, the North Eastern Railway Company would inaugurate the first electric locomotive to work heavy traffic in England. These engines, he added, would be constructed at the North Road Works. Mr. Raven also made an interesting statement concerning superheated locomotives. His department, he said, designed and built 20 express locomotives for working the heavy main line express trains between York and Edinburgh, having three high-pressure cylinders. Ten were ordinary engines with 180 lb. pressure and cylinders 15½ in., and 10 were superheated with cylinders 16½ in. and 160 lb. pressure. In every other way they were similar. The average coal consumption for 1912 for the non-superheated was 47·8 lb. per mile, and for the superheated 38 lb. per mile, which showed a saving per mile of 9·8 lb., or 20 per cent. The firebox of the superheated engines was found to be in much better condition after 18 months' running than those of the non-superheated, and he expected the cost of boiler repairs would be very much less owing to decreased pressure in the boiler. He could not prophesy the future of the steam locomotive, but it was certain that it had a keen competitor in the electric locomotive, which would run it a hard race in the future.

Berlin Railway Electrification.—The Lower House of the Prussian Diet on April 22 passed a bill authorising the expenditure by the Government of a sum exceeding a million sterling on preparations for the electrification of the Berlin City Circular and Suburban Railways.

NOTABLE PERFORMANCE OF ELECTRIC ACCUMULATOR RAIL MOTOR CAR.

American newspapers report a remarkable run of a car equipped with the Beach-Edison storage batteries which took place on March 6. The vehicle ran from the Grand Central Station in New York to Boston *via* the New York Central and the Boston and Albany Railways, the distance being 310 miles, the actual running time 11 hours 6 mins. 51 secs. The average was thus 26 miles per hour, but over certain portions of the route a speed of considerably more than 100 miles per hour is reported to have been attained. The car is 50 ft. long and 12 ft. 6 in. high, 8 ft. 11 in. wide, and weighs, complete with load, 34·6 tons. There are seats for 50 passengers.

The electrical equipment of the car consists of four 20-H.P., 75-ampere, 220-volt Diehl motors and two sets of 230 cells each of Edison storage battery, delivering current to the motors at approximately 240 volts. The cells were of the A-8-H Edison type of nickel steel alkaline batteries for power, and five cells for light. They are placed under the car in two compartments, strongly reinforced with structural shapes and riveted to the frame. The batteries are of the special railway type, having 3 inches of water for the plates. The wheels are driven by a gear placed on the inner side of the wheel hub, the ratio of reduction being 3·5 to 1.

Before the car left New York the batteries had been fully charged, and a run of 114 miles to Hudson was then made at the average speed of 35 miles per hour. The energy consumption for this distance was 37½ watts per ton-mile. The battery was charged, and the car then ran on to Springfield, Mass., 98 miles from Hudson with about one-third of the full charge left in the batteries after having climbed to an elevation of 1,450 ft., including one continuous up grade of 1 in 100 for about 8 miles. At Springfield, the battery was given a short boosting charge and the run to Boston, 98 miles, was then completed.

Appended is a condensed report of this notable run:

RUN FROM NEW YORK TO BOSTON.

Actual running time	11 hrs. 6 mins. 51 secs.
Total distance	306·71 miles
Average miles per hour	27·6 m.p.h.
Total number kw. hours	369·1
Average kw. hours per car-mile	1·2
Average watt hours per ton-mile	·035
Average watt hours per ton-mile	35·0
Total ampere hours	1,303
Average ampere hours per car-mile	4·25
Average ampere hours per ton-mile	124
Average voltage, calculated from amp. hour and kw. hour.	283
Average current, calculated from volts and kw. hour	117
Free running amperes	176
Free running volts	285
Free running speed	37
Free running watt hours per ton-mile	39·5
Free running car friction	16·6 lb. d.b.p.
Maximum speed	42 m.p.h.
Average of accelerating current	203·7
Total charging time on run	3 hrs. 27 min. (3·45 hrs.)
Total ampere hours from charging	973
Average charging current	353
Average charging voltage	429
Total kw. hours charging	522
Ampere hours discharged from batteries to Boston	219·4
Ampere hours discharged from batteries to Boston	178
Average voltage, calculated from ampere hour and kilowatt hour	282
Excess kilowatt hours available at Boston	55
Excess ampere hours available at Boston	195
Battery efficiency, calculated from test figures	52·7

Weather condition: Rain from Grand Central Station to Poughkeepsie; light snow from Poughkeepsie to Hudson; heavy snow from Hudson to Chatham; high cross wind and drifting snow from Chatham to Springfield; six degrees above zero from Springfield to Boston.

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PAY-AS-YOU-ENTER CARS AT ABERDEEN.

A year ago, on the recommendation of Mr. R. S. Pilcher, general manager of the Corporation Tramways, the Aberdeen Town Council decided to introduce the P-A-Y-E system on certain of the city routes, and on April 28 the service was inaugurated on the Woodside section, when ten prepayment cars were put into operation. Six of these are new, while the other four have been converted from ordinary cars for use with the new system. New pattern tickets have also been introduced for the specific purpose of meeting the demands of the P-A-Y-E system, and these have already been commented upon in our columns.

All the ten prepayment cars were drawn up at Sea-Beach terminus, where they were inspected by the members of the Town Council, officials, and invited guests. The features of the system were explained in detail and in practice by Mr. Pilcher and his traffic superintendent, Mr. W. Forbes, while Mr. H. M. Howard, the secretary, and Mr. A. F. Paul, the engineer of the International P-A-Y-E Tramcar Company, Limited, were also present and pointed out the salient advantages of the patent.

The inauguration proper took place at the junction of Union Street and St. Nicholas Street, when all ten cars were put into service. The first P-A-Y-E passengers were Dr. Gordon, the town clerk, and Chief Constable Anderson. The civic party, headed by Bailie Barron, chief magistrate, and Councillor J. A. Smith, convener of the Tramways Committee, participated in a trial trip to the Woodside terminus and back, and *en route* a good opportunity was afforded to test the efficiency of the new system. Rain fell in torrents, and the cars were in demand, while a returning football crowd at Kittybrewster further tested the experiment. The loading of the cars was accomplished with surprising expedition, there being no delays and no missed fares. At the congested terminus at Union Street equally satisfactory results were achieved, which gratified the experts present and pleased the public immensely. A full service was maintained throughout a wet evening, and, as the Woodside route is easily the busiest in the city, the prepayment system was subjected to a test as severe as it was protracted and thorough. Not a hitch occurred. The ordinary cars were withdrawn, the new cars brought into exclusive operation, and the public were enthusiastic in their praise of the new system. There was a visible tendency to "exit" from the rear in the case of the top-deck passengers, but this will be remedied by experience. Mr. Pilcher, Mr. Howard, and Mr. Paul followed the progress of the new cars throughout the whole evening, and expressed themselves much gratified at the inaugural success of the venture.

Inauguration of P-A-Y-E System at Aberdeen.

A civic banquet followed the opening ceremony. Bailie Barron presided, and proposed "The Aberdeen Tramway Undertaking and the P-A-Y-E System." He said the new venture marked a spirit of enterprise on the part of the Corporation.

Mr. J. A. Smith, tramways convener, in replying, said the introduction of the P-A-Y-E system was a most important forward step which would be watched with interest by the whole country. The new cars were absolutely the latest in tramway construction. They were equipped with more powerful motors, with the very last word in brakes, and with a faultless electric lighting installation. The prepayment cars would be of benefit to the public in respect of convenience and speed of service, less crowding and expedition in loading; they would help the conductor who would have less physical fatigue, and they would be of advantage to the Town Council because of the fact that there would be no missed fares. He commented on the fact that Aberdeen was the first city to decide on the introduction of the P-A-Y-E system, which he was sure would be a credit to the city and a boon to the public.

Mr. H. M. Howard, responding to the toast of "The Guests," said: To Aberdeen belongs the distinction of being the first town in the kingdom to realise the feasibility of applying the P-A-Y-E system to double-deck cars, and to take the initiative by actually constructing, and putting in trial service, the first double-deck cars—thus showing

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the way to other cities. As you all know, Leicester has been operating 10 P-A-Y-E cars for the last six weeks, and, to quote the words of the chairman of the Tramways Committee, "the cars have justified every claim made for them in the prevention of accidents, the comfort of passengers, acceleration of service, and increase of traffic receipts." But this does not discount the fact that Aberdeen decided and actually built the first double-deck P-A-Y-E car. History repeats itself, and we have found by actual experiment in Gateshead and Leicester, that the system is as elastic and as adaptable to all conditions, and overcomes all difficulties here, as in the past it did in the western hemisphere. The public has shown a remarkable aptitude in meeting the requirements of the system; such as, having the correct amount of fare ready; its willingness to enter and leave the car according to the specified regulations. This is specially true of the ladies, and the children take a real delight in tendering their fares to the conductor, and gravely depositing their tickets in the box as they leave. P-A-Y-E has been the subject of keen consideration of tramway managers throughout the kingdom for the past 18 months, and naturally, this interest will now centre on Aberdeen, and I may safely predict that you soon will have many delegations from other cities anxious to study the system in actual operation. The ten cars you have just inspected are the last word in tramcar construction; they have been equipped with every modern device for the comfort and safety of passengers. They are one more proof of the good judgment of your manager; and I would mention that in adopting the P-A-Y-E system, Aberdeen is only giving credit to Scotchmen, as the invention of the P-A-Y-E is one from the brains of two good Scotchmen one Ross and the other Macdonald—who thought of and perfected the invention whilst in the employ of the Montreal Street Railway.

Pay-As-You-Enter Cars—Aberdeen Corporation Tramways.

In thanking you for the invitation extended to my company to be present on this occasion, I am reminded of the proverb that says it is ill to judge by outward appearances. Outwardly, Aberdeen well deserves its name of "Granite City," but the warmth of my reception proves to me that the old adage is right, for the hearts of Aberdonians are not in keeping with the exterior of their dwellings.

Mr. PILCHER, general manager of the Aberdeen Corporation Tramways, extolled the prepayment system, and confessed that personally he had the greatest confidence in the P-A-Y-E system, although it was by no means perfect yet. In the case of large cars seating 56 people, with the ever-increasing halfpenny fares and stages, and the consequent greater loading of the cars, it was well nigh impossible for a conductor to perform efficiently all the duties that were imposed upon him. Of course, in adapting this system to particular towns there would be local circumstances to be considered and difficulties to be got over, but he was sure that the Aberdeen public would rise to the P-A-Y-E cars and would appreciate their advantages. They would yet see the full advantages when other towns followed in the wake of Aberdeen.

TRAMWAY INSPECTOR'S REPORT ON THE NEW SERVICE.

We append the report of the inspector who attended the working of the new service on the first day. It appears from this that no difficulty of any kind has arisen, and that the public thoroughly appreciate the good points of the system: "My time on duty spent in attending to loading P-A-Y-E cars; found no trouble. It wasn't even necessary to ask intending passengers to have their fares ready: no difficulty about the time-keeping. During the afternoon the cars were causing a good deal of interest; on the arrival of one of the new cars a crowd would at once gather. What seemed to take the fancy of the bystanders most was the smooth and quick method of fare collecting. Very few required money changed; any who did were asked to stand into the well of the platform until it was convenient to have change given. Instructed conductors to deal in this manner in cases where required. I did not hear one unfavourable comment on the new cars to-day. From remarks overheard from bystanders and passengers the P-A-Y-E car has surpassed public expectation. The exit for top passengers *en route* being at the front end seems to be a great advantage from what I hear people say who have used it. One passenger who has travelled on Woodside for many years, always using the top, says it is a great advantage in the event of a heavy loaded car—which often occurs on the Woodside route—as it was a serious matter getting down through the crowd of passengers on the old cars standing on stairs and rear platform, and ten chances to one before one got through the car had passed the desired station. Now this sort of thing can't happen."

RAIL CLEANING.

"Rail Cleaning" is the title of a well-printed and useful little pamphlet issued by the Consolidated Accessories Company, of 27, Clement's Lane, London E.C. The importance of proper rail cleaning is emphasised by extracts from a paper by Herr Schorling, chief engineer of the Hanover Tramways, read at the International Tramways Congress held at Brussels in September, 1910. Herr Schorling says that in view of the ever-increasing traffic in our streets, economical cleaning of tramway rails becomes more and more important. He sets forth the disadvantages accruing from insufficient rail cleaning. Cleaning by manual labour is too slow, costs too much, and must gradually, he says, give way to mechanical cleaning, which is both cheaper and more efficient. Mr. H. M. Sayers, engineer-in-chief of the City of Santos Tramways, Brazil, is also quoted as emphasising the importance of rail cleaning which reduces energy consumption and repairs. With this introductory testimony, the "Q-Fel" rail cleaner, which is now in use on more than 65 tramways, is illustrated and described. The pamphlet concludes with instructions for fixing and operating these cleaners, and drawings are given showing the method of attaching them to the trucks. In conclusion, the authors of the pamphlet say that rail cleaners are still in very much the same discredited position as was occupied until recently by meters, but they venture the prediction that before long rail cleaners will have amply demonstrated the fact that they too can play a very important part in tramway economy.

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LONDON UNDERGROUND RAILWAY DEVELOPMENTS.

PROGRESS OF BILLS IN PARLIAMENT.

In addition to the developments of the underground electric railway system of London, which are already authorised and under construction, it will be remembered that at the beginning of the present session of Parliament, six bills were introduced for the purposes of extensions, junctions, and so forth. These measures are now practically through the House of Lords and are in such a position that little doubt can be felt that they will be passed in their present form by the House of Commons also. The first bill to be dealt with by a House of Lords' Committee—the Metropolitan Railway Bill—was less fortunate than the others, as on April 16, while it was partly passed, some of its main proposals were rejected. The bill proposed to sanction the acquisition by the Metropolitan Railway Company of the Great Northern and City Railway, and to extend the Great Northern and City line from the present terminus at Moorgate Street southwards past the Bank of England to a junction with the Waterloo and City Railway, so that trains might be run between Finsbury Park and Waterloo terminus of the London and South Western Railway. It was also proposed to make a junction line between the Metropolitan Railway at Liverpool Street and the Great Northern and City at Moorgate Street, so that trains might be run from the one railway on to the other. There was much opposition to the proposed extensions. In regard to that which would pass the Bank of England, it was contended that buildings would be endangered, because the tunnels would have to come comparatively near the surface in order to pass over the tunnels of the Central London Railway. The other extension met with opposition from those interested in the buildings and garden at Finsbury Circus. This part of the scheme—the junction line between Liverpool Street and Moorgate Street—was withdrawn by the promoters, and it is understood that an amended proposal will afterwards be brought forward. Clearly enough, if the Metropolitan Company are to get any benefit from acquiring the Great Northern and City line a physical junction must be provided between the two railways. The Committee sanctioned the acquisition of the Great Northern and City undertaking and also the construction of the extension as far as Lothbury (at the north side of the Bank of England) but no farther.

A different story has to be told regarding the five bills promoted by companies which are associated with the Underground Electric Railways Company of London. These bills were formed into a group which came before a Committee of the House of Lords in the latter half of April. Some of them proved to be unopposed, and the opposition to others was of such a minor character that they were speedily passed by the Committee. In what may be called the old days, the idea of those concerned in the construction and working of tube railways was that each line should be a self-contained unit and have no physical connection with any other railway. It was thought that in this way the very frequent service of trains required could be run with greater facility and safety. That idea of the necessity for such isolation, however, was dissipated by the opening of the Charing Cross, Euston, and Hampstead Railway, the northern half of which consists of two branches, one to Hampstead and the other to Highgate. The same lesson has been learnt from the Metropolitan District Railway which, though not a tube line, is for a great proportion of its length underground, and has a number of junctions. After it was electrified the train service was increased to an extent which a few years ago would have been unbelievable. Hence there is nothing novel in the principle of connecting underground electric railways with one another, or with lines in the country.

Taking in order the five bills, whose success we may now consider as assured, we first have the Central London Railway Bill, authorising the extension of the railway from Uxbridge Road, Hammersmith, to a junction with the London and South Western Railway at Gunnersbury. Such opposition as had existed to this measure was withdrawn. The bill promoted by the City and South London Railway Company has the important object of enlarging the tunnels (which are smaller than those of other tube railways), so as to allow of through trains being run between this line and the Charing Cross, Euston, and Hampstead Railway. The bill met with a good deal of opposition on details, but the preamble was passed and the details were adjusted by the Committee on consideration of the separate clauses. The London Electric Railway Bill, which was passed by the Committee after a short hearing, provides for the construction of a junction line between the City and South London Railway at Euston, and the Charing Cross, Euston, and Hampstead Railway at Camden Town. When this line has been constructed, and when the City and South London tunnels have been enlarged, it may be expected that through trains will be run between Clapham on the south and Golder's Green on the north. Moreover, the work of constructing the authorised railway from Golder's Green to Edgware is now being pushed forward, so that within a not very distant time trains may be run between Edgware and Clapham right across the heart of London. The London Electric Railway Bill also provides for a junction at Hammersmith between the Great Northern, Piccadilly, and Brompton Railway and the London and South Western Railway. Thus the latter undertakings will have two connections with London tube lines besides its present connection with the Metropolitan District Railway. As all the suburban routes of the London and South Western Railway are about to be electrified, there is a prospect of running through trains if desired, both *via* the Central London Railway and the Great Northern and Brompton Railway to and from the country. The Metropolitan District Railway Bill, which has now been added to the unopposed list, besides authorising a widening and a station improvement, provides for the working of the Wimbledon and Sutton authorised railway by the District Company. The Wimbledon and Sutton line will thus become an extension of the District Company's route to Wimbledon. The last of the bills is that promoted by the Wimbledon and Sutton Company for increasing their capital and extending the time for the construction of the authorised railway. The proposed undertaking is now controlled by the Underground Railways Company, so that there is no longer any doubt of the capital being found. The bill was passed by the Committee after a short hearing.

These schemes, taken in conjunction with the already authorised junction line between the Baker Street and Waterloo Railway and the London and North Western Railway stand for great developments in the near future. It is telling no secret to say also that it is highly probable that the Underground Railways Company will before long apply to Parliament for further powers for extensions of the great net-work of electric lines which they control. Unlike other local transport agencies in the metropolis, they do not need to fear motor omnibus competition, for the principal London omnibus companies are also under their control.

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THE

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Motor Vehicles and Road Maintenance.

The question whether local authorities or others running trackless trolley vehicles or motor omnibuses over the roads of other local authorities should contribute to the maintenance of these roads is again being extensively debated on numerous private bills relating to the subject now before Parliamentary Committees, and it cannot be said that so far the position arrived at is very satisfactory. Probably the most definite finding which has been come to is that reached by Sir Ivor Herbert's Committee of the House of Commons on the Chesterfield Corporation Railless Traction Bill. A strong attempt was made by the county authority to get a mileage rate in respect of running of trackless trolley vehicles over parts of the county roads. The Committee, however, declined to grant any clause of the sort. They recognised that it was desirable that there should be public legislation dealing with the matter as a whole, but in view of the delay which would be incurred if promoters had to wait for that, they felt it necessary to deal with the present case on its merits. While refusing the mileage rate, however, they inserted a clause in the bill rendering the Corporation liable for damage arising out of the extraordinary traffic proposed by the bill. Such damage is to be assessed at the end of three years by arbitration between the county and the borough. It will be observed that while this Committee have adhered to the decisions of previous Committees on bills of the kind that no fixed contribution shall be made by the owners of trackless trolley or motor omnibus vehicles for road maintenance, they have taken a new step in making arbitration to ascertain road damage compulsory. An arrangement of the kind has already been made in some cases by voluntary agreement between parties. It is a question how far liability can, under the present law, be fixed on the owners of trackless trolley vehicles, because there is a well enough known process by which the owners of heavy vehicles of any kind may be sued by the road authority for compensation or damage done to roads by reason of what is called extraordinary traffic. It is doubtful how far comparatively light vehicles, such as railless trolley cars or motor omibuses if under five tons weight, will be held to be the cause of extraordinary wear to a road. There is no doubt that motor omnibuses, in the latest and most improved form, produce less wear than the ordinary vehicles of the kind did a year or two ago, and it is also highly probable that railless trolley cars will produce even less wear than the motor omnibuses. Sir Ivor Herbert's Committee have a number of other railless traction bills under consideration, and doubtless, should the same point be raised in regard to any of them, a similar decision will be given. In that case, a quite new vista is opened up, because if statutory obligations are put upon local authorities to contribute towards road maintenance, should that be found just by an arbitrator, the whole question will arise of motor omnibus companies in London and elsewhere contributing to the cost of repairing the streets on which they run. It is eminently desirable that we should have general legislation putting the whole matter on a clear and satisfactory basis, not merely for this locality and that, but for the whole country. The tendency of events indeed seems to be in the direction of a reversion to the principle of toll-bars. We deal with the subject from the point of view of the motor omnibus industry in our motor traffic section.

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Finance of London County Council Tramways.

In our records of electric tramway accounts the loans outstanding against the London County Council tramways on March 31 last is given as £11,309,789; in the next column appears £2,423,040, being the aggregate of loans repaid and sinking funds. The deductions from gross profit on account of interest for the year was £334,173, and £369,353 is set down as charged to the credit of sinking funds. Mr. Norman, chairman of the Finance Committee, has since supplied some later figures in his statement to the Council delivered in connection with the consideration of estimates of expenditure for the coming financial year. The total debt outstanding on the tramways is now £9,916,000, and the debt charges—interest and sinking fund—£738,000, that is to say, about 7½ per cent. per annum, £388,042 having been found out of the surplus of earnings during the year ended March 31 last for repayment of capital. Whatever critics of the policy pursued in respect to the tramway undertaking of the Council may say, it is difficult to infer from these figures alone that the financial condition is other than healthy. Any tramway company that was earning 7½ per cent. on its entire capital, whether represented by shares or debentures, would not lack the approval of discriminating investors; and we do not think that ratepayers need feel greatly perturbed by those critics of the press who so frequently pronounce the doom of an undertaking which is absolutely essential to the people of the metropolis, and which has, therefore, complete economic justification for an increase in fares, should such a step ever become necessary. In any consideration of the tramway position it must not be forgotten that an enormous number of passengers who now travel at workmen's fares pay less than the actual cost of their carriage. If the Council had kept before them the principle that "every passenger should pay for his ride and get full value for his money," the position of the undertaking to-day would be such that ratepayers would not have the slightest excuse for anxiety. Apparently the London tramway debt bears interest at the rate of about 3½ per cent. on the average, and the proportion of the charges set aside for the redemption thereof is more nearly 3¾ per cent. Such an annual provision for the repayment of loans would cancel them entirely in rather less than 19 years, if accumulated at 3¾ per cent., or rather more than 19 years if the rate was 3½ per cent. As the 2½ per cent. London County Council stocks are now quoted at about two-thirds of the nominal value, and the 3 per cents. at under 70, the yield being therefore between £3 15s. and £3 16s. per cent., this authority should have little difficulty in finding a remunerative use for any sinking fund money it may have at its disposal, though these particular stocks are said not to be redeemable until after 1920. Another point which is of special importance in regard to these tramways is the fact that a large proportion of the expenditure incurred has been of a character that is not subject to deterioration or waste of any kind unless obsolescence has to be provided against, and in that case obsolescence involving the total abandonment of electric traction on the conduit system. Of the immense sum expended per mile in building these tramways, a large proportion was spent in altering and re-arranging gas pipes, water pipes, and drainage tubes, and in repaving and widening the streets used. This sort of capital expenditure is subject to no deterioration, and therefore requires no fund to be accumulated for its replacement, except in the event that the object for which it was incurred is no longer sought. One is reminded of the academic problem, what proportion of the capital cost of freeing England from wolves should be set aside annually for replacement. If tramways are to be a permanent institution, there is a great deal of the debt standing against the London County Council tramways that can safely be dealt with by means of a sinking fund which requires more than 19 years to extinguish it. The number of miles open on March 31 was 255¾, and the loans outstanding £11,309,789, as has been stated, or something like £45,000 per mile. Probably the whole could have been built for half that sum on unobstructed ground.

Storage Battery Traction.

Great claims have been made on behalf of the Edison storage battery for several years, and of late some progress has been made in America in its application to electric tramways and local railways. Probably the most remarkable run by a battery car which has yet been recorded is

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that which took place some four weeks ago from New York City to Boston. As stated in the condensed report given on another page, the total distance is 307 miles, and the journey was accomplished in a little over 11 hours, by a car weighing 34½ tons complete and seated for 50 passengers. One of the difficulties with accumulator traction is, of course, the fact that after a certain mileage the batteries must be recharged. It is a feature of the Edison cell, however, that it may be charged and discharged with great rapidity without any ill effect. On the run to Boston, before recharging, the car travelled 114 miles. The next stage was 95 miles, when about one-third of the charge was still in the batteries, although during the run a climb to an elevation of 1,450 ft. had been made. The third stage of 98 miles was completed by the aid of only a short boosting charge. So far, therefore, as the use of storage battery cars or trains on short branch railways is concerned the problem of charging seems to be solved. There are so many advantages in electric traction that railway companies who now work local branches where the traffic is light by means of steam, petrol, or petrol-electric vehicles may be induced to experiment with the battery car where there is an electric generating station easily accessible. The cost of experiments in the direction indicated would, of course, be trivial compared with the ordinary process of electrifying a railway. Apart from other things, reports on prolonged tests made in America go to show that the Edison battery possesses extraordinary durability, and that its efficiency—that is, the ratio of output to input—is very high.

The Brill Magazine.—The 12 monthly numbers of the magazine published by the J. G. Brill Company (Philadelphia, U.S.A., and 110, Cannon Street, London, E.C.) have been issued as an annual volume of 384 pages, substantially bound in half leather. Its object is to supply descriptions of interesting rolling stock of the Brill manufacture, supplemented with particulars of the services for which the various types of cars are used. There is an index in tabular form, giving the different types of cars, and the tramways for which they have been constructed. Fifteen of these are enumerated on 63 systems. Of miscellaneous articles there are nine. The conditions which govern the type of car for city services in 12 towns are described, and there are a large number of very good illustrations. The various types of the P-A-Y-E cars illustrated indicate that this innovation has steadily gained ground during the past year. The latest novelty in tramcar design is the stepless cars which have been constructed for New York and Brooklyn, and these are described and illustrated. Five types of trucks are described, and there are eight miscellaneous equipments, the trucks being illustrated with drawings in which the various parts are clearly enumerated. Short biographies and portraits of a number of tramway managers are included in the book, among which are striking likenesses of the general managers of Nottingham, Glasgow, and West Ham Corporation Tramways. Altogether, the book is one which every tramway manager will find as useful as it is interesting.

LONDON TRAFFIC INQUIRY.

EVIDENCE OF THE MANAGER OF THE WEST HAM TRAMWAYS.

The House of Commons Committee who are inquiring into accidents caused in London by power-driven vehicles, on April 10 took the evidence of Mr. H. E. BLAIN, manager of the West Ham Corporation Tramways, who presented a number of tables giving particulars of the West Ham cars, conditions of employment of motormen, and particulars in regard to accidents. The four types of life-guards used on the cars had come into operation on 183 occasions since 1904. Mr. Blain said that he was strongly of opinion that many street dangers were due to preventible causes, such as the negligence of pedestrians and cyclists, the wanton and apparently unheeded obstruction of the road, disregard of the rules of the road, antiquated, obsolete, chaotic, and incomplete traffic law and regulations, and the absence of any one authority with supreme power on traffic matters. He had occasionally taken summonses out against children who mischievously interfered with vehicles, but the magistrates had no power to order birching. Cycling should be forbidden in very congested areas. Vehicular traffic was jammed for considerable periods in crowded roadways, and there was no power to deal with this effectively, different authorities shifting the responsibility from one to another. Carts, etc., were left for hours when not in use outside shops, because they were believed to be an advertisement. Witness drew attention to the evils of "nursing" and cutting off on routes where motor 'buses and tramcars were in competition, and spoke strongly of the unfair manner in which this competition has been conducted, alluding to the heavy charge on the tramcars, varying from £180 to £220 as compared with the petrol tax, which was stated to represent about £43 per 'bus per annum. Passengers were often deterred from entering the cars at stopping places by the 'bus being driven straight at them, the horn being sounded without apparently any slackening of speed. Alluding to the necessity of a central traffic authority, Mr. Blain thought that the present overlapping was unnecessary from the point of view of the public, irksome and harassing for those responsible for providing traffic facilities, and generally prejudicial. He offered three alternative suggestions for the construction of such a board: (1) A permanent board consisting of five members, as recommended by the Royal Commission; (2) an elected board either of an authority composed of representatives of local authorities; or (3) of investing the London traffic branch of the Board of Trade with full authority. Unrestricted competition in public traffic he did not consider desirable. Mr. Blain suggested that any Traffic Board should be given full powers to regulate public traction routes in the whole of the metropolitan area. The local authorities should have the opportunity of expressing their views, but the Traffic Board should give its decision after inspection by their own engineering and traffic staff.

The Committee continued hearing the evidence of Mr. H. E. Blain on April 15. In answer to the Chairman's query as to whether the tramway employees are overworked, he stated that the conditions under which the men work are among the best in the country, the hours are fairly short, and the wages among the highest. It was much easier to drive a tramcar than a 'bus in his opinion, and he thought that the hours worked by 'bus drivers were detrimental to the safety of the public. Many accidents had been caused in West Ham owing to 'buses running across the track in front of a car at such an acute angle that they collided with the car. There had also been accidents through 'buses pulling up quickly in front of cars in order to pick up passengers. In answer to Mr. Benn as to the advisability of the police having more powers, he agreed that they should, but incidentally mentioned that they do not enforce the powers they have sufficiently. Speedometers on the cars had been tried at West Ham, but the results had not been very encouraging. One of his reasons for objecting to the use of speedometers was that if a man found himself exceeding the speed limit, and whilst he was pulling up he met with an accident, the speedometer might not fall back quickly enough, which would be a very serious thing for the man. That 'buses cause more accidents than tramcars, he attributed to the fact that the car has a fixed course, and therefore could be avoided much more easily, and to the increasing number of inexperienced drivers on the road. Mr. Blain submitted a census of motor 'buses and tramcars taken at Bow Bridge on Wednesday, December 4 last, between 5 a.m. and midnight. The 'buses going to the city numbered 622, and the tramcars 684. From the city the numbers were 627 and 686. During the year ended November 30 last the 'buses collided with tramcars on 153 occasions. In only 28 instances were the collisions due to the negligence of tramcar drivers, the remainder being caused by the negligence of the 'bus drivers. A census of passengers carried on tramcars and the 'buses at a given point on a typical through-running route on a Sunday between 9 a.m. and midnight gave the total in cars as 5,891, and in the 'buses 2,491 on a journey from London. On the inward journeys the numbers were 6,331 and 3,271. On three week days on a through-running route 1,743 cars carried 34,121 persons, and 1,123 'buses contained 16,596 passengers.

MANAGING DIRECTOR OF THE METROPOLITAN ELECTRIC TRAMWAYS.

Mr. J. DEVONSHIRE, managing director of the Metropolitan Electric Tramways and various other companies, stated with regard to brakes,

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the Metropolitan Electric had a magnetic brake, which was only used in cases of emergency, but the London United cars had not, although the London United Tramways management was satisfied with the efficiency of the cars. The Metropolitan Electric cars had a periodical inspection. Many accidents are due, in his opinion, to the carelessness both of pedestrians and drivers of vehicles. Taxicabs were a serious danger. All 'buses should be made to stop in the rear of tramcars. Slow moving traffic should be made to keep to the side of the road, and should carry rear lights. He did not think it would be possible to limit tramcars and 'buses to certain roads, as there was certain to be a little overlapping. A Traffic Board should be appointed by Parliament, and should be composed of not more than five members. They should have the power to veto the local authorities, and should not be responsible to the ratepayers.

On April 17 the Committee continued the evidence of Mr. Devonshire, who mentioned that the emergency brakes on the Metropolitan cars are tested 12 times a day under the conditions in which they were intended to be used. These brakes are not used for service stops. There is an agreement between the Metropolitan Tramways and the London General Omnibus Company with regard to fares. If the 'buses run over the first penny stage of the Metropolitan route, then the Omnibus Company must pay 25 per cent. of the net profits in respect of that competition. The Underground Electric Railways have a substantial interest in the London and Suburban Traction Company, but they do not control it. The London and Suburban Traction Company controls the Metropolitan Electric Tramways and the London United Tramways. The London General Omnibus Company is controlled by the Underground Electric Railway Company. The latter hold 30 or 31 per cent. of the capital of the Metropolitan Tramways Company. In 1911 these tramways carried 6,000,000 passengers without a fatal accident, but they had met with three fatal accidents in 1912. During the last four years they had met with 26, 25, 81, and 187 accidents respectively. This rapid increase was probably due to motor omnibuses running on the tramway routes. He pointed out that tramcars contribute largely to the upkeep of roads, whilst motor 'buses do not, and he did not see why all classes of motor vehicles should not contribute.

Other witnesses have been Captain Deasy (Roads Improvement Association), Mr. E. S. Smith (Royal Automobile Club), Mr. C. H. Dodd (Automobile Association and Motor Union), Mr. F. Wilde (Automobile Association and Motor Union).

Mr. J. E. Davies, secretary of the Society of Motor Cab Drivers, who had driven about 150,000 miles, chiefly in London, said that drivers in his society had had 52 collisions with motor 'buses and three with tramcars, and had been run into by horse vehicles 92 times. Motor drivers should have longer terms of training than at present.

Mr. Kendall, chief clerk in the offices of the Commissioner of Police, on April 22 gave evidence respecting street accidents. His testimony was the reverse of the case which the Commissioner endeavoured to put forward when giving his evidence. Mr. Kendall compared the figures showing accidents in roads where motor 'buses and motor vehicles generally were running together, and where motor vehicles and tramcars were running, and said the greater number of accidents occurred in the former places. The worst places were where the streets were entirely devoid of tramcars. The total mileage of tramways was 334.

The Chairman: The greatest problem we have to deal with is where there are no tram lines?—Yes.

Managing Director of the General Omnibus Company.

Mr. A. H. Stanley, managing director of the London Underground Railways and the General Omnibus Company, on April 29 appeared before the Select Committee of the House of Commons, who are inquiring into accidents caused by power-driven vehicles in London. He stated that the present number of the 'buses only satisfied the requirements of the traffic. The company had had no fewer than 32 different types of motor 'buses. The requirements laid down by the police had been very useful. The 'buses had developed a higher efficiency, the laden weight had been reduced from 5 tons to 3 tons 10 cwts., and the vehicles were much less noisy. He had had a great deal of experience of tramways in America. When the cars were first introduced there a very large number of fatal accidents occurred. As the drivers became more experienced the public intuitively became more careful, and the vehicle itself was made more safe through the introduction of life-saving devices, so that fatalities had become rarer. He believed that the same experience would occur in London with the 'buses. The tramway system, he thought, was not capable of carrying all the traffic of the streets without the assistance of the 'buses. The relative efficiency of the omnibus to the tramcar was almost as two was to one. The 'bus was an independent and self-contained traffic unit, capable of movement wherever it might be required to go at any time and under any circumstances.—Mr. Kellaway: You introduced the hustling methods of the States into this slow-going country?—Witness: I do not think so. The English people, I think, are more apt to take to improvements and more rapid methods than the American people. I have certainly found them much more appreciative. The increase in the number of 'buses was now about 10 'buses a week. These were almost entirely 'buses of the M.E.T. Company.—Mr. Kellaway suggested that the roads had been broken up by the 'buses—Witness said he was not aware of it.—Have you not been informed of it by the local authorities?—Yes, there have been complaints that the 'buses have caused damage, but I do not think anyone has actually proved that it is the case. Mr. Stanley said his ideal would be that the 'buses should be under one control. They had got as near to that as possible by means of working agreements. They did not aim beyond that; at least, they had nothing in contemplation. The agreement the London General had with all the other companies except Tilling's and the National Steam secured the same result as would be secured if the London General actually owned them. It would be to the safety and interest of the public that all the 'buses should be under the same control.—Mr. Munro: Your ideal is to exclude competition and create a monopoly?—Witness: We don't say that. We believe the public interest is best served by having the 'buses controlled by one company. The same consideration should also apply to tramways; they should be under one control. He denied that he desired to exclude competition, but agreed that absence of competition meant less danger, and in his view that was desirable.—Replying to Mr. Kellaway, Mr. Stanley said they had working agreements with all the tramways in London except those which were municipally owned. He would regard the ideal state of things as being that all 'buses and tramways should be under the same control. In 1911 there were 107, and in 1912 150 fatal accidents. He claimed that the fatal accidents were less in 1912 in proportion to the number of 'buses run, the number of miles run, and the number of passengers carried. A driver was entitled to assume that a pedestrian was not deaf, and did hear the warning sound. If drivers assumed that pedestrians were deaf they would never get the 'buses along the streets.

On May 1 Mr. Stanley gave evidence concerning the training of motor omnibus drivers and their working conditions, and the steps taken to keep the vehicles in thorough order. The vehicles were also frequently inspected by the police, sometimes in the garages and at other times in the streets. He stated that a tramcar driver was not suitable for driving a motor 'bus, owing to not being able to adapt himself to the flexibility of the vehicle. The motor cab driver was also unsuitable owing to the slower speed limit to which he would have to apply himself. Drivers underwent 26 days' training before undergoing the police test. After that an experienced driver made journeys with him at intervals, and reported to the garage superintendent as to his ability. As a final precaution, cinematograph demonstrations of accidents and how to avoid them were given to the drivers. Altogether 357 persons were employed in the traffic department in the checking of the services and in the discipline of the staff. These were in addition to 67 persons employed in a similar capacity by the engineering department. Forty-four regulators were employed to prevent congestion and ensure the proper spacing of 'buses on the road, and there were 222 timekeepers recording the times at which the 'buses passed given points. The control staff consisted altogether of 582 persons, or one to every 14 or 15 persons employed. The company censured drivers arriving at points ahead of the schedule, but subject to a sufficient explanation there was no censure attached to their being late. The problem of keeping the motor 'bus in motion while allowing for the need for rest for the men was solved by allowing each man to undertake only part of the daily work of a 'bus. The average weekly mileage of the 'bus was 804, and of the driver 417. The average length of the early shift for drivers was 11 hours, of the late shift 12 hours, and of the relief shift 15¼ hours, of which 9¾ hours was actually spent in driving. Each driver took the relief shift every third week. It was a regulation of the company that no man should start duty unless an interval of eight hours at least had elapsed since he left off his previous day's duty. The company ought to take steps if possible to increase it.

PROPOSED LONDON TRAFFIC BOARD.

The General Purposes Committee of the London County Council reported at the meeting of the Council held on April 29, that having regard to the evidence which the Select Committee of the House of Commons on motor traffic had received, it seemed desirable that further evidence should be submitted of the Council's views as to the establishment of a Traffic Board on the lines recommended by the Royal Commission on London Traffic. The Committee accordingly recommended that the Select Committee on motor traffic be asked to receive evidence from Sir Edward White on behalf of the Council on the establishment of a Traffic Board.

Sir John Benn, after a long speech on the general question of London traffic, moved as an amendment that Sir Edward White's evidence should urge that the control of the traffic of London should be handed over to the County Council.

The Chairman, however, ruled the amendment out of order on the ground that the Council had already decided in favour of the establishment of a Traffic Board, and that the amendment was therefore a rescinding motion.

After further discussion the Committee's recommendation was agreed to.

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LONDON TRAMWAY BREAKDOWNS.

At the meeting of the London County Council on April 22 Mr. W. J. Squires (Woolwich) asked the chairman of the Highways Committee whether he was in a position to state the circumstances relating to the accident which took place at the Greenwich generating station on April 14 last.

Sir EDWARD WHITE: I am able to give that information. I have taken the opportunity since last we met of going to the Greenwich station with the chief officer and trying to make myself acquainted on the spot with the position of matters there, and I now beg to present this reply, which I think will give all the information that the various members who asked the questions last week desired to obtain. There has not been an opportunity, I am sorry to say, of submitting the whole of this report to the Highways Committee, because the time available did not give me sufficient opportunity to make myself acquainted with it. I informed the Council on April 15 of the facts, so far as they were known, relating to the accident which occurred at Greenwich generating station on the morning of April 14, which necessitated the temporary suspension of the tramway services. I stated that the investigations into the causes were still proceeding, and that it was not then possible to make an authoritative statement, but promised, if possible, to give a full report at the next meeting, and at the same time furnish, as far as possible, detailed particulars of other accidents which had recently resulted in serious dislocation of the tramway services.

Accident on January 27.

The first case this year happened on January 27, when a serious dislocation of the electric tramway system took place at about 8-25 p.m. The supply at the generating station fell to a very low pressure, due to a severe short circuit about half a mile from the station on one of the high-tension cables. As a result, the automatic relays tripped various sub-station circuits. These were switched in again at 8-35, but a second disturbance took place at 8-40, and a third at 8-43, which delayed the resumption of the supply. The supply was again renewed at 8-57. Some 1,200 cars were affected between 8-25 and 8-57. Five motor generators and one transformer broke down at various sub-stations in connection with the accident. Four of the five motor generators had been in use for nearly 10 years, and arrangements had already been made for them to be rewound.

Accident on March 10.

The second accident occurred on the evening of March 10. During the day the generator attached to No. 7 turbine was examined by the repairs staff when it was shut down after the peak load in the morning, and in accordance with the usual practice, the isolating plugs were withdrawn and the terminals were earthed for the safety of the repairs staff.

After the examination had been completed, the turbine was run up for the evening load at about 4-30 p.m., but the switchboard attendant forgot to remove the safety earth wires. As a result, severe arcing took place at the switch gear contacts belonging to No. 7 generator, which flashed over to the contacts of generators 6 and 8 adjoining. A very severe short circuit then occurred, shutting down the entire supply and breaking down a number of coils on engine generator No. 3. Supply was resumed by one machine within five minutes, and by three other generators as soon as they could be started. Serious delays occurred to the traffic, as sufficient power was not available to run all the cars; a considerable number of cars had to be run into the depots, and full supply could not be resumed until after 7 p.m., owing to repairs being necessary on the switch gear of turbine generators Nos. 6 and 8. Following on this accident a defect developed on No. 7 turbo-generator two days afterwards, but as very prompt action was taken to shut the turbine down, only four coils were damaged.

Accident on April 14.

With regard to the accident which occurred on April 14, it appears that at 8-55 a.m. the cotter at the bottom end of the high-pressure piston rod on one side of No. 2 engine at the station fell out, and the piston head and rod were driven through the cylinder cover, causing considerable damage to the engine. A piece of broken metal apparently struck the coils of the generator stator, setting up a severe short circuit. The engine was shut down as soon as possible. The most serious trouble so far as the tramways service was concerned was the short circuiting and fire on the switchboard galleries. The cables from one of the main joint boxes immediately above the switchboard also caught fire, the box exploded and fell down into the lower switch gallery. All plant had to be shut down to enable the switch gear to be put in a safe condition for working, which was done in about two hours. Resulting from the trouble on the switchboard a number of rotor bars on No. 7 turbo-generator overheated and damaged the insulation; the rotor is now being rewound. The Fire Brigade had been called out by someone in the street, but by the time the Brigade arrived the fire was almost out. The Brigade staff, however, rendered every possible assistance, and the sump in the basement at the station which had become partially flooded was pumped out by the aid of a fire engine. Supply was resumed by the five machines shortly after 11 a.m., and in the meantime with a view to supplementing the car service temporary arrangements were at once made with certain other tramway authorities adjacent to the Council's system for a temporary supply of power. Owing to the serious nature of the damage to the plant arising from the accidents referred to, it was impossible immediately to obtain a sufficient supply of power to work the whole of the cars required for the running of the tramways service during the busy periods of the day. In consequence, arrangements were made with the Board of Trade to admit of the carriage for a limited period of an excess number of passengers in the tramcars. By this means the inconvenience to the public arising from the breakdown of the plant was as far as possible lessened. I should like to take this opportunity to state that the greatest credit is, in the opinion of the Highways Committee, due to the staff for the expedition, skill, and promptitude with which, on each occasion, they have dealt with situations presenting the greatest difficulties in such a manner as to cause the least possible inconvenience to the public, and in the way they have safeguarded in every possible direction the very valuable plant affected.

MANCHESTER TRAMWAY CLOCK.

A large public clock has recently been placed outside the offices of the Manchester Corporation Tramways at 55, Piccadilly. As will be seen from the illustration, the clock occupies a conspicuous position, and it is greatly appreciated by the public It is worked electrically

from a master clock inside the offices, which is synchronised daily from Greenwich at 10 a.m. The diameter of the dial is 6 ft., and the clock, which was supplied by the Synchronome Company, of London, is 55 ft. above the street level.

MELBOURNE RAILWAY ELECTRIFICATION.

The Victorian Railway Commissioners, in addition to placing the contracts for plant and rolling stock in connection with the electrification of the suburban railways, as detailed in our issue dated March 29, have undertaken to order sub-station equipment from Siemens Brothers Dynamo Works within one year to the extent of 60,000 KW. at an estimated cost of £168,000. The Commissioners also hold options, operative for two years, under these contracts, for two additional generating sets for the second boiler house, 15,000 KW. of sub-station plant, and car equipment for 100 motor and 50 trailer coaches, which form the balance of the scheme.

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FIRST GRANT UNDER THE LIGHT RAILWAYS ACT, 1912.

Work is expected to be begun immediately for the construction of the Dingwall and Cromarty Light Railway, the Treasury having resolved to advance £48,000, partly by way of gift and partly as a loan. Until the Light Railways Act of last year, the Treasury, before giving assistance, required promoters to produce guarantees for both the working and the construction of the line The latter condition, no longer obligatory, has been waived in this case, and it has also been agreed that the advances of the local authorities should have priority as to repayment over those of the Treasury. The total cost is estimated at £96,000, towards which sum half has been raised by the local authorities and private subscribers, who have also entered into an agreement for the Highland Railway Company to work the line for 50 years, and with a contractor to construct it.

CAR AND TRACK SUPPLIES AT THE BUILDING EXHIBITION.

The Building Trades Exhibition, the 5th of a triennial series held at Olympia, was open from April 12 to 25, and both as regards the excellence of the exhibits and the attendance was a complete success. A particular feature this year was the large number of stands that had been designed by architects for the better display of goods, this being especially noticeable in the exhibits made by the various manufacturers of paint and enamel. As in past years the main exhibition was organised by Mr. H. Greville Montgomery, while the "Surveyor" section occupied the whole of the galleries and was organised by "The Surveyor and Municipal and County Engineer." The ground floor exhibits numbered some 250, and comprised all branches of the building trade together with brick making machinery, concrete building blocks and the plant for making them, concrete mixers, constructional steel work, art metal work, etc. Electric lifts of various patterns were exhibited, Messrs. Waygood having two running in regular service conveying passengers to and from the gallery. Messrs. Scholey and Company, Limited, of Queen Victoria Street, London, E.C., had a large size working model showing the general arrangement and details of the Graham electric passenger lift working upon the "push button" system, with the gear fixed below. The gear of this lift embodies several special features, it being specially designed to give quiet running and low current consumption together with perfect safety.

Amongst paint and varnish manufacturers were noticed Pinchin, Johnson, and Company, Limited, whose exhibit comprised a handsome structure called the "Temple of Minerva." This was entirely finished with the firm's satinette enamel, gloss white and flat white, except the dome, which was gilt. There was also a number of practical specimens of work done with "Minerva" paints and "Deydol" distempers in various colours, also "Veritone" stains and other specialities manufactured by the company at their works at Silvertown.

Robert Kearsley and Company, Limited, of Ripon, also had an exceptionally fine exhibit. This stand took the form of a Greek temple with forecourt. The woodwork of this had been prepared and finished throughout with Messrs. Kearsley's materials, the main walls being finished with "Arkalac" flat enamel and the columns with "Arkalac" gloss enamel. On the stand was shown a number of panels painted with Messrs. Kearsley's colours and finished with their special decorator's varnish.

The Ruberoid Company, Limited, had a well-arranged stand, and their exhibit included Ruberoid roofing in various thicknesses and colours. A specimen of a flat roof made up of 3-ply roofing on concrete foundations attracted considerable attention as it served to show the method of application for this class of roof. Ruberoid roofing is manufactured at the company's works at Brimsdown, Middlesex, by a special process, and is largely used for public buildings, docks, factories, railway and commercial buildings of all kinds. It is proof against time, weather, water, acids and alkalis, and is unaffected by heat or cold. The Ruberoid Company also exhibited the P. and B. preserving paints, insulating paper, and other specialities.

In the "Surveyors'" section the exhibits represented the various branches of municipal engineering work, and included several forms of road-making materials, plant, and appliances. Amongst the latter was a comprehensive display of tools, plant, and stores for contractors, public authorities, railways, and tramways on the stand of Messrs John Yates and Company, Limited, of Birmingham. These included various sections of portable track, rail dogs, fish bolts, turntables, portable railway switches, and a large assortment of railway and tramway permanent way appliances, including jim-crows, rail carts, rail jacks, rail levers, etc. There was also a collection of the Yates special "Hurricane" lamps in various forms, similar to those supplied to the London County Council and other Corporations. Barrows, buckets, pumps, tar boilers and tools, rollers, tip-wagons, and general stores made up a collection which appeared to embrace the entire requirements of the permanent way department.

FINANCIAL REPORTS AND MEETINGS.

Calcutta Tramways.—The receipts for 1912 were £217,033, working expenses £122,166, and net revenue £94,867, which, with the balance forward from 1911, makes £98,803. A final dividend of 5s. per share is proposed, making 7½ per cent. for the year, adding £15,000 to the depreciation fund, and carrying forward £4,625.

Bradford Tramways' Receipts.—The receipts from passengers and parcels for the year ended March 31 amounted to £289,616, compared with £282,376 for the preceding year, an increase of £7,239. During the year 62,000,000 passengers were carried, an increase of 6,000,000. The increase has occurred chiefly in traffic before 9 a.m.

Hobart City Tramways Loan Issue.—£250,000 4½ per cent. debentures the interest guaranteed by the Government of Tasmania — were offered for subscription in London on April 8 and 9 at the price of £100½ per cent. The issue was over-subscribed. The money is required in connection with the purchase of the Hobart Tramway Company's undertaking, and the construction of an extension.

Oldham, Ashton, and Hyde Electric Tramways Company.—The receipts for 1912 amounted to £34,579 and the expenditure (including £1,600 for debenture interest and £4,000 placed to provision for renewals account) to £27,791, leaving a net profit of £6,788, while £179 was brought forward. The directors propose to place to reserve fund £1,250, to pay a dividend on the ordinary shares at the rate of 7 per cent. per annum, making 6 per cent. for the year, and to carry forward £218.

Wemyss and District Tramways to be Double-Tracked.—The accounts for 1912 show a divisible balance of £3,643, after appropriating £1,000 for betterments and providing for debenture interest. Two dividends of 3 per cent each have been declared on the ordinary shares, and £896 added to the reserve. At the annual general meeting on March 29, Mr. George Balfour, the chairman, stated that it was the intention of the directors to proceed to double the line by degrees, gradually linking up the whole service.

Creditable Year's Work at Oldham.—Report has been made to the Tramways Committee that the year ended March 25 was a record one. The year was a record one in receipts, number of passengers carried, and in diminution of working expenses. There had been a profit of £4,500, notwithstanding that £1,400 had been given in increases of wages. Councillor Isherwood said the profit enabled them to wipe out a loss of £2,413 sustained last year. The cars had run 104,603 more miles than last year, and used 106,133 fewer units.

Successful Year at Birmingham.—The tramways accounts for the financial year show that the traffic receipts amount to upwards of £573,000, an increase of more than £150,000 compared with the previous year. A year ago £46,000 was applied in relief of rates, but it is not expected that this sum will be exceeded this year, as the reductions in fares had an immediate tendency to reduce the earnings by a penny a car-mile. The concessions to passengers were equal to nearly £80,000. A sub-committee are considering proposals for further extensions of the tramways.

Babcock and Wilcox, Limited.—The net profits for 1912 were £426,147, or £46,000 odd more than a year ago. The total dividend for the year is at the rate of 16 per cent., or at the rate of 32 per cent. on the capital as it stood a year ago, before it was doubled by the capitalisation of the reserve. To that fund £150,000 is to be added, against £130,000, and £10,000 is again to be placed to the staff pension fund. To counteract the increased cost of coal, wages, and the Insurance Act expenses, further extensions both to the selling and manufacturing organisations had been, and were still being, carried out. For this purpose an issue of £200,000 5 per cent. cumulative second preference shares is recommended at par.

Swansea Improvements and Tramways Company.—The report for the year ended December 31 states, with regard to the tramway undertaking, that the revenue amounted to £63,813, being an increase of £1,031. Traffic receipts amounted to £61,368, an increase of £888. After deducting all expenses chargeable to revenue, and after setting aside the sum of £7,000 to the renewals fund, there remained a surplus of £12,136, and the addition of £1,713 brought forward made the available balance up to £13,849. The directors proposed that this balance should be allocated as follows: To reserve £3,000, preference dividends at 6 and 5 per cent., and dividend on ordinary shares at 5 per cent., carrying forward £1,751.

Tynemouth and District Electric Traction Company.—At the twenty-third ordinary general meeting of the Tynemouth and District Electric Traction Company, Limited, the chairman, Mr. H. S. Day, said that the revenue for the year was £13,661, a decrease of £508. After deducting all expenses chargeable to revenue, including £1,000 for renewals, and writing off a loss of £278 on sale of Consols, there remained £4,377, which, with the £551 brought forward, made a balance of £4,929. The directors had placed £1,250 to reserve, and recommended that a dividend of 5 per cent. be paid on the cumulative preference shares and 4 per cent. on the ordinary shares, and that

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£297 be carried forward. The renewals and reserve funds would then amount to £19,502.

Increased Profit and Decreased Expenses.—The Bury Council tramways made a profit on the year's working of £10,800. Of that sum £9,500 was on the Bury system, and £1,300 on the Radcliffe section. There was a combined profit of £1,250 more than last year, while the working expenses showed a decrease of £1,000. The Tramways Committee recommend an allocation of £5,000 to the relief of the rates. The consideration of an appeal from the Bury Football Club for a grant towards the fund for clearing the club's liabilities has been deferred until it is seen what amount is raised from other sources. When the club was in the First League Division the tramways reaped a profit of £500 from football traffic, but on the club going down to the second division the tramway receipts dropped by £200.

Wigan Converts a Loss into a Profit.—Alderman Rushton informed the Town Council at their April meeting that the receipts from fares for the year had been £71,291, as against £66,329, or an increase of £4,962. The total receipts were £73,004 and the payments £72,452, leaving an estimated profit of £552, which would probably be more when they got the exact figures. That position was very satisfactory to the committee and to the management, and he was sure it was satisfactory both to the Council and to the ratepayers of the borough. He could only re-echo what was said by the chairman of the Finance Committee at the last meeting, when the rate was being fixed: "They should put something on one side for a renewal account." Councillor Bradshaw mentioned that in 1911-12 they lost over £4,000, and to have brought that to a profit was a magnificent effort.

Halifax Tramway Profits.—The tramway profits for the year ended March 31 last are estimated at about £15,000. The receipts amounted to £105,840, an increase of £3,947 compared with the previous year, and the expenditure, less interest, sinking fund, Parliamentary expenses, etc., was £69,000, an increase of £6,110. Coal has cost £691 more, £780 is for the abandoned Parliamentary bill, and an additional £800 has gone in rates. The car-mileage was 2,152,000, an increase of 49,243, and the cost of units per car-mile was 1·82d., compared with 1·69d. The latter increase was partly due to top-covered cars. During the year 19,500,000 passengers were carried, an increase of 750,540, or equivalent to 111 times the population. The expenditure on motor 'buses, less interest and sinking fund, was £750, and the receipts amounted to £718, or 8·33d. per mile run. The 'buses have only been running during the last six months, and more favourable returns are expected in the summer.

Belfast City Tramways.—The report submitted to the City Council by Mr. Andrew Nance, the general manager, shows that the revenue for the year ended March 31 amounted to £254,377, and the working expenses to £143,293, leaving a profit of £110,834. Net revenue charges amount to £57,149, including interest on debt, fixed annual payment of £8,961 to the general purposes fund, income tax, stamp duty, etc. The profit disposable is £53,933. This profit has to be dealt with in accordance with the Aberdeen clause of the Belfast Tramways Act, 1904, and the balance is thus appropriated as follows: Sinking fund, £24,540; depreciation fund, £13,000; general purposes fund, £16,393. The appropriation to the general purposes fund is placed at the disposal of the Finance Committee, in addition to the £8,961 fixed by statute. Mr. Nance reports that the scheme adopted on his recommendation in March last, which virtually provides for the payment of bonuses, has worked satisfactorily. The number of accidents has much diminished, and he has no doubt that the new system has contributed to this result. The number of passengers was 58,437,942, the total revenue per car-mile 10·67d., the working expenses 5·78d., and energy consumption 1·4 units.

Metropolitan Electric Tramways Company and Omnibus Competition.—The revenue for 1912 was £518,025, and the divisible balance is £57,374. A final dividend of 3 per cent. is proposed on the ordinary shares, making 5½ per cent. for the year, a reduction of ½ per cent., adding £10,000 to reserve, and carrying forward £604. The profit derivable from the operation of the tramways and light railways shows a decrease of £24,347. This unsatisfactory result is attributable to the heavier competition from motor omnibuses. In order to meet this increasing competition, and to maintain the company's hold upon the traffic, the directors augmented the car services, and while this policy has enabled the company to maintain its receipts the working expenses are higher by £24,348, and the receipts per car-mile have dropped from 10·59d. to 9·63d. The number of passengers rose from 89,908,700 to 91,508,700, and the number of car-miles run from 10,433,100 to 11,482,900. It is anticipated that the alliance entered into with the London General Omnibus Company at the close of the year will bring about the co-ordination of the omnibus and tramway services in the company's area, and a consequent improvement in revenue. Reference is also made in the report to the successful through running inaugurated with the London County Council tramways.

Liverpool Corporation Tramways.—The report of Mr. C. W. Mallins, general manager of the Liverpool Corporation Tramways, for the year ended December 31, 1912, shows that the revenue amounted to £668,220, and the operating costs were £425,018, leaving a gross profit of £243,202, which has been apportioned as follows: Interest, £50,096; sinking fund and repayment of loans, £59,248; reserve, renewal, and depreciation account, £66,929; leaving £66,929 to be appropriated in aid of the rates. The contribution to the rates was £28,685 in excess of the amount handed over in 1911. In previous years the Tramways Committee were only allowed to contribute one-third of the net profit in relief of the rates, but this restriction has now expired, and the committee have contributed this year one-half of the profits. The number of passengers aggregated 134,249,967, an increase of 5,624,593, or 4·4 per cent. The average earnings per car-mile amounted to 12·03d., an increase of ·39d. The traffic receipts, car-mile earnings, and passengers carried are the highest recorded. Allusion is made to the two new types of tramcars which were ordered from the United Electric Car Company, Limited, Preston, to Mr. Mallins' designs, and which have been described in these pages. The single-truck car was put in service on January 7, 1913, and this car, it is stated, has in every way fulfilled the advantages claimed for it. The committee have ordered six more of this type of car. During the year 14 new cars have been added to the rolling stock, bringing the total number of cars in stock to 587.

Anglo-Argentine Tramways Company.—The report of the working of this company for the year ending December 31 last shows that the receipts amounted to £2,778,303, less working expenses (which include various items amounting in the aggregate to £135,000 carried to depreciation renewal funds, in addition to £301,181 expended on ordinary maintenance) £1,824,022, leaving £954,281. To this sum had to be added £10,947 brought forward, making £965,228, less interest and charges as per net revenue account £755,922, leaving £209,306, less interim dividend of 4 per cent. on ordinary shares for half-year ending June 30, 1912, £100,000 = £109,306. Out of this balance, the directors recommended a final dividend of 4½ per cent. on the ordinary shares for the half-year ended December, 1912, making 8½ per cent. for the year, which, after deduction of income tax £6,198 will absorb £100,052, leaving £9,254 to be carried forward. The weather in 1912 was, from a tramway point of view, worse than in 1911. The passengers per car-kilometre increased from 4·04 to 4·11. Expenditure increased by £88,644 (5·62 per cent.), wages accounting for £55,360, stores £17,737, and taxes £20,792; current diminished by £6,702. Presiding at the general meeting on April 22, in London, Mr. J. B. Concannon stated although many of the services continued to be adversely affected by the work of constructing the subways, the directors anticipated satisfactory results for the complete year.

Another Record Year at Leeds.—As in 1911-12 the receipts of Leeds Corporation Tramways for 1912-13 again establish a record. In the former year the increase on the previous year's figures amounted to £24,900, and for the year ended March 31 last an increase of £16,212 is recorded. The comparative statement of total receipts, miles run, etc., is as follows:

	1912-13.	1911-12.	Increase.	Percentage of Increase.
Total receipts	£411,533	£395,320	£16,212	4·1
Miles run	8,795,465	8,527,957	267,508	3·13
Passengers carried	89,668,185	86,021,943	3,646,242	4·23
Receipts per mile	11·229d.	11·125d.	·104d.	0·9
Average fare per passenger	1·688d.	1·689d.	—	—
Number of times population carried	179	172	7	4·06
Amount paid per head of population	16s. 3d.	15s. 6d.	7d.	3·72

During the year just ended there has been no extension of the routes, whereas in the previous year the system was linked up with Morley and the trackless system was introduced between City Square and Farnley. The summer, too, was wet. Whereas the total revenue is up by 4·1 per cent., the increased percentage of car-miles run is only 3·13. Of the sum of £19,809 set aside for rates and taxes, £5,300 is being held over pending a decision in the House of Lords in the case of the Metropolitan Tramways Company. The Court of Appeal has held that the company's lines ought to be rated as light railways, on one-fourth of their value only. The Tottenham Urban Council are taking the case to the House of Lords. If the appeal is dismissed the profits at Leeds will benefit to the extent of the sum now held over. After providing for every form of expenditure, and excluding the sum of £5,300 already referred to, there remains £61,374 to be used for the relief of rates, an increase of £211. This amount is nearly equal to a rate of 7d. in the pound. Of the 11d. received per car-mile, 3d. is absorbed by traffic expenses, 2d. of this going in wages to the drivers and conductors. Roughly, 1d. is absorbed by general expenses, 1d. by repairs and maintenance, ½d. by power expenses, 1d. by interest on capital, 1½d. by contributions to sinking fund, 1d. by permanent way renewals, and 1·675d. by the sum paid over in relief of rates.

Proposed Tramways Exhibition.—Any firms who wish to take part in a proposed exhibition to be held in connection with the conference of the Municipal Tramways Association at Sheffield in September next, are invited to communicate with Mr. A. R. Fearnley, the president of the Association, at the Tramway Offices, Division Street, Sheffield.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls.	Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Loans Repaid and Sinking Fund.	Depreciation, Renewal and Reserve Funds.	Gross Receipts. Traffic.	Other.	Total.
Aberdeen ...	* May 31, 1912	Dec., 1899	E.	27	60	350,000	346,075	3,925	346,075	12,471	196,825	149,250	119,621	76,130	1,050	77,180
Accrington ...	* Mar. 31, 1912	Aug., 1907	,,	10	53	169,675	132,822	36,853	133,125	12,488	118,547	14,578	9,641	25,756	465	26,221
Ashton-u-Lyne..	* Mar. 25, 1912	Aug., 1902	...	8	15	130,070	108,099	21,971	108,099	13,203	83,240	24,859	1,650	21,340	551	21,891
Ayr	* May 15, 1912	Sept., 1901	,,	7	49	128,000	74,405	53,595	82,914	10,892	64,417	16,078	14,028	15,092	660	15,752
Birmingham ...	* Mar. 31, 1912	Jan., 1904	,,	101	37	2,019,900	1,894,772	125,128	1,870,937	...	1,729,633	165,138	190,441	434,048	6,052	440,100
Blackburn ..	† Mar. 25, 1913	Mar., 1899	,,	24	63	408,174	342,474	65,700	334,924	13,512	254,600	167,381	1,000	63,440	3,243	66,683
Blackpool ...	* Mar. 31, 1912	June, 1899	,,	21	31	438,028	294,483	143,545	295,984	13,839	294,483	102,855	16,259	64,313	1,027	65,340
Bolton	* Mar. 31, 1912	Dec., 1899	,,	47	17	552,208	548,208	4,000	538,958	11,416	381,750	145,383	45,920	131,155	991	132,146
Bradford ..	* Mar. 31, 1912	July, 1898	,,	(h)101	74	1,269,568	978,063	291,505	965,366	9,471	635,883	355,633	75,120	274,328	15,007	289,335
Brighton	* Mar. 31, 1912	Nov., 1901	,,	17	15	279,070	274,905	4,165	274,905	15,994	229,717	40,174	5,834	52,144	1,884	54,028
Burnley	* Mar. 31, 1912	Dec., 1901	,,	21	5	388,052	278,032	110,020	209,348	9,939	168,989	50,161	47,430	72,454	255	72,709
Burton-on-Trent	* Mar. 31, 1912	Aug., 1903	,,	9	60	108,632	104,562	4,070	106,012	10,873	55,762	48,800	8,243	14,823	1,343	16,166
Bury	† Mar. 31, 1913	June, 1903	,,	21	14	407,800	280,775	127,025	283,005	13,365	262,135	42,877	(l)24,571	67,370	284	67,654
				(b)13	21											
Chester	* Mar. 25, 1912	April, 1903	,,	6	35	92,991	82,380	10,611	82,934	12,883	71,027	11,490	1,998	12,343	477	12,820
Chesterfield ...	* Mar. 31, 1912	Dec., 1904	,,	5	8	95,000	70,500	24,500	69,575	13,642	60,289	10,211	5,031	11,709	496	12,205
Colchester ...	* Mar. 31, 1912	July, 1904	,,	7	75	70,748	69,555	1,193	69,401	8,740	55,805	14,700	...	10,284	450	10,734
Croydon	* Mar. 31, 1912	June, 1906	,,	18	10	287,689	287,689	Nil	284,847	15,608	232,636	78,027	37,206	92,539	1,891	94,430
Darlington ...	* Mar. 31, 1912	June, 1904	,,	8	71	107,500	76,165	31,335	76,322	8,587	58,431	17,175	4,504	11,491	383	11,874
Darwen	* Mar. 31, 1912	Oct., 1900	,,	7	13	93,400	86,300	7,100	85,748	11,972	60,670	25,718	6,400	14,530	241	14,771
Derby	* Mar. 31, 1912	July, 1904	E.	22	5	...	...	...	242,476	10,999	191,798	50,678	(a)4,005	E 46,388	975	47,363
			H.			...	...	...	...	...	...	...	...	H 407	18	425
Doncaster ...	* Mar 31, 1912	June, 1902	E.	11	62	103,900	94,500	9,400	95,025	8,070	82,400	13,020	27	17,417	252	17,669
Dundee	* May 15, 1912	July, 1900	,,	27	38	...	341,416	...	349,854	12,734	266,161	77,173	60,984	62,016	664	62,680
East Ham ..	* Mar. 31, 1912	June, 1901	,,	14	32	189,524	187,073	2,451	...	191,260		50,374	...	57,342	668	58,010
Exeter	* Mar. 31, 1912	April, 1905	,,	7	0	106,000	86,111	19,889	86,111	12,301	71,325	15,243	4,925	17,290	Nil	17,290
Gloucester ...	* Mar 31, 1912	April, 1904	,,	15	2	191,000	144,243	46,757	147,692	9,846	113,280	14,587	...	15,894	1,108	17,002
Halifax	* Mar. 31, 1912	June, 1898	,,	54	20	450,313	402,735	47,578	403,255	7,433	302,139	95,385	21,561	100,884	1,010	101,894
Ilford	* Mar. 31, 1912	Mar., 1903	,,	11	28	149,633	149,633	Nil	149,136	13,140	114,806	34,827	7,648	27,294	2,272	29,566
Ilkeston	* Mar. 31, 1912	May, 1905	,,	4	24	64,214	47,000	15,074	47,936	11,148	42,600	11,919	350	6,533	156	6,689
Ipswich	* Mar. 31, 1912	Nov., 1903	,,	14	70	116,471	114,300	2,171	114,838	7,720	100,735	14,228	4,966	22,358	581	22,939
Keighley	* Mar. 31, 1912	Oct., 1904	,,	6	9	50,934	46,903	4,031	46,903	7,673	34,465	15,080	1,310	9,588	251	9,839
Kilmarnock ...	* May 15, 1912	Dec., 1904	,,	5	47	65,000	48,246	16,754	52,666	9,426	48,205	6,090	2,749	8,400	237	8,637
Kirkcaldy ...	* May 15, 1912	Feb., 1903	,,	8	65	213,000	92,581	120,419	96,749	11,041	77,885	14,696	3,643	15,584	481	16,065
Lancaster ...	* Mar. 31, 1912	Jan., 1903	,,	4	65	60,000	51,550	8,450	43,412	9,021	39,000	12,371	3,000	5,566	144	5,710
Leith	* May 15, 1912	Aug., 1905	,,	17	73	275,000	235,000	40,000	235,000	13,119	193,200	42,257	302	33,851	842	34,693
Leyton	* Mar. 31, 1912	Dec., 1906	,,	18	40	306,427	305,821	606	295,526	15,977	256,643	40,906	3,360	61,496	1,172	62,668
Lincoln	* Mar. 31, 1912	Nov., 1905	S.	2	77	98,519	44,940	53,579	44,992	15,187	44,168	8,587	1,488	6,688	126	6,814
Liverpool ...	* Dec. 31, 1912	Nov., 1898	E.	119	0	...	...	...	2,015,193	16,934	1,245,282	1,012,873	430,509	631,071	13,103	644,174
Lowestoft ...	* Sep. 30, 1912	July, 1903	,,	4	6	94,230	87,031	7,199	87,031	21,357	67,833	13,067	...	10,781	17	10,798
Maidstone ...	* Mar. 31, 1912	July, 1904	,,	7	3	82,932	82,582	350	78,748	11,012	69,158	13,424	Nil.	9,279	518	9,797
Manchester ...	* Mar. 31, 1912	June, 1901	,,	184	78	2,355,689	1,988,871	366,818	1,998,595	10,811	1,618,779	385,471	447,507	845,460	11,329	856,789
Nelson	* Mar. 31, 1912	Feb., 1903	,,	3	69	38,000	36,349	1,651	36,430	...	29,602	6,747	...	9,371	41	9,412
Newport (Mon.)...	* Mar. 31, 1912	April, 1903	,,	14	35	219,250	193,250	26,000	192,934	13,363	166,653	35,432	9,958	36,361	821	37,182
Nottingham ...	* Mar. 31, 1912	Jan., 1901	,,	36	40	730,300	..	...	635,128	17,401	439,128	197,036	69,201	160,190	2,408	162,598
Oldham	* Mar. 25, 1912	May, 1902	,,	27	67	516,923	436,704	80,219	441,047	15,395	333,746	113,339	(a) 1,419	101,280	819	102,099
				(b) 8	31											
Perth	* May 15, 1912	Nov., 1905	,,	6	40	90,000	77,650	12,350	77,829	11,539	64,790	13,678	1,034	9,689	412	10,101
Plymouth ...	* Mar. 31, 1912	Sept., 1899	,,	15	0	...	188,752	...	157,322	...	92,636	97,320	10,848	37,083	830	37,913
Pontypridd ...	* Mar. 31, 1912	Mar., 1905	,,	8	48	136,019	135,885	134	136,896	15,919	112,862	22,899	...	21,130	2,036	23,166
Rawtenstall ...	* Mar. 31, 1912	May, 1909	,,	15	71	196,159	182,933	13,226	181,036	11,401	169,971	12,962	2,150	24,063	1,018	25,081
Rochdale... ...	* Mar. 31, 1912	May, 1902	,,	(i) 40	2	356,991	347,782	9,209	351,831	15,347	347,782	71,729	...	72,649	353	73,002
Rotherham ..	* Mar. 31, 1912	Jan., 1903	,,	12	0	228,550	155,000	73,550	154,589	12,882	132,835	46,413	18,123	35,724	133	35,857
Salford	* Mar. 31, 1912	Oct., 1901	,,	75	0	1,050,666	723,669	326,997	723,324	9,644	581,149	237,090	48,964	253,962	70	254,032
Southampton ...	* Mar. 31, 1912	Jan., 1900	,,	17	62	277,259	239,715	37,544	247,977	13,951	169,010	70,726	18,497	63,849	2,260	66,109
Southend-on-Sea	* Mar. 31, 1912	July, 1901	,,	11	49	130,000	129,961	39	143,808	12,384	116,940	12,784	3,045	34,453	465	34,918
Southport ..	Mar. 31, 1909	July, 1900	,,	10	61	292,000	197,200	94,800	195,967	10,314	144,240	52,960	9,001	19,218	341	19,559
South Shields ...	* Mar. 31, 1912	Mar., 1906	,,	10	21	251,882	174,935	76,947	172,322	16,791	156,111	26,920	15,864	32,160	772	32,932
Staly'ge, H., M., D.	* Mar 31, 1912	May, 1904	,,	27	57	325,270	273,470	45,800	279,778	10,096	230,488	48,982	173	39,198	365	39,563
Stockport ...	* Mar. 31, 1912	Aug., 1902	,,	27	50	305,028	234,500	70,528	238,199	8,623	176,002	58,498	54,219	59,594	1,245	60,839
Sunderland ...	* Mar. 31, 1912	Aug., 1900	,,	20	35	308,676	303,211	5,465	304,882	14,982	192,752	101,576	23,112	67,871	363	68,234
Wallasey ...	* Mar. 31, 1912	Mar., 1902	,,	19	69	192,546	191,249	1,297	210,671	10,606	167,586	53,395	10,544	57,337	770	58,107
Walsall	* Dec. 31, 1912	Dec., 1902	,,	19	44	188,145	188,100	45	183,351	9,378	156,161	31,939	30,879	30,629	800	31,429
Walthamstow ...	* Mar. 31, 1912	June, 1905	,,	12	42	180,000	180,000	Nil	173,081	13,846	163,679	16,321	2,757	38,249	741	38,990
Warrington ...	* Mar. 31, 1912	April, 1902	,,	9	52	103,674	102,896	778	102,128	10,583	77,094	25,802	10,000	21,338	335	21,673
West Ham ..	* Mar. 31, 1912	Feb., 1904	,,	27	62	563,412	551,463	11,949	553,275	19,919	553,441	77,711	41,944	143,087	1,060	144,147
Wigan	* Mar. 31, 1912	April, 1901	,,	(k) 34	2	492,158	481,022	11,136	472,654	13,891	405,638	115,240	...	66,329	1,241	67,570
Wolverhampton	* Mar. 31, 1912	April, 1902	S.	21	40	279,733	265,616	14,117	277,510	12,908	223,496	55,578	45,891	51,452	807	52,259
Yarmouth (Gt.)...	* Mar. 31, 1912	June, 1902	E.	14	32	144,500	119,750	24,750	121,322	8,425	112,550	19,623	5,739	24,380	520	24,900

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls.	Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Loans Repaid and Sinking Fund.	Depreciation, Renewal and Reserve Funds.	Gross Receipts. Traffic.	Other.	Total.
Belfast	* Mar. 31, 1912	Nov., 1905	E.	81	25	1,556,272	1,131,200	425,072	1,125,864	14,041	1,093,000	152,675	89,406	239,263	3,805	243,068
Bexley	* Mar. 31, 1912	Oct., 1903	,,	6	42	99,942	96,984	2,958	96,924	14,854	78,800	18,184	(j) 1,074	13,826	1,542	15,368
Birkenhead	* Mar. 31, 1912	Feb., 1901	,,	24	7	371,474	364,854	6,620	366,708	15,222	259,103	105,724	15,076	59,282	4,369	63,651
Bournemouth ...	* Mar. 31, 1912	July, 1902	,,	(e) 29	62	449,027	434,462	14,565	438,194	19,601	341,688	113,617	5,656	91,422	233	91,655
Cardiff	* Mar. 31, 1912	May, 1902	,,	31	66	813,923	787,292	26,631	783,051	24,683	583,869	203,422	86,411	125,743	19,181	144,924
Glasgow	* May 31, 1912	Oct., 1898	,,	185	35	3,451,487	3,503,174	(g) 51,687	3,532,736	19,051	2,546,923	956,251	1,921,361	987,280	3,795	991,075
				(b)11	29											
Huddersfield ...	* Mar. 31, 1912	Feb., 1901	,,	46	0	646,284	398,942	247,342	416,528	9,055	261,716	146,610	13,253	101,482	3,120	104,602
Hull ...	* Mar. 31, 1912	July, 1899	,,	29	43	669,273	510,805	158,468	511,273	17,309	505,511	133,787	133,028	151,164	1,622	152,786
Leeds	* Mar. 31, 1912	Aug., 1897	,,	112	62	1,588,406	1,531,789	56,617	1,490,162	13,805	1,232,742	432,775	4,487	391,142	4,179	395,321
Leicester... ..	* Dec. 31, 1912	May, 1904	,,	37	0	739,240	719,223	20,017	722,021	19,514	607,476	129,211	100,000	134,966	12,705	147,671
London	* Mar. 31, 1912	...	H.	23	30	(c)	(c)	(c)	...	...	...	...	..	60,357	1,335	61,692
		May, 1903	C.E	255	60				11,850,127	...	11,309,789	2,423,040	920,402	2,231,902	62,587	2,294,489
N'castle-on-Tyne	* Mar. 31, 1912	Dec., 1901	E.	60	20	1,520,425	1,199,962	320,463	1,176,339	19,574	932,552	342,271	104,670	216,590	10,044	226,634
Northampton ...	* Mar. 31, 1912	July, 1904	,,	9	13	128,300	127,255	1,045	134,122	14,638	95,488	31,766	10,360	26,784	701	27,485
Portsmouth ..	* Mar. 31, 1912	Sep., 1901	,,	30	66	640,011	682,319	...	696,792	22,599	471,739	210,580	85,307	110,792	1,810	112,602
Preston	* Mar. 31, 1912	June, 1904	,,	17	16	224,101	187,269	36,832	187,269	10,888	129,765	37,200	31,466	40,355	292	40,647
Reading	* Mar. 31, 1912	July, 1903	,,	13	14	235,000	232,000	3,000	227,430	17,262	174,040	51,582	14,651	33,151	1,119	34,270
Sheffield	* Mar. 25, 1912	Sep., 1899	,,	76	58	1,465,674	1,374,390	91,284	1,375,381	18,163	1,071,665	378,280	25,917	337,801	3,203	341,004
Wellington, N.Z.	* Mar. 31, 1912	...	,,	30	7	538,523	538,523	Nil	603,798	20,189	538,523	36,008	87,561	138,229	481	133,710

C = Electric conduit system. E = Electric trolley system. H = Horse lines. S = Surface contact system. (a) Accident insurance fund. (b) Lines leased and worked. (c) Conferred by Annual Money Act, which limits amount for each financial year. Powers not exercised are lapsed. (e) Includes 7 mi. 34·53 chs. single track lines leased. (g) Borrowing powers exercised in excess. (h) Includes 1¼ miles railless trolley route. (i) 17 mi. 8 chn. single track leased. (j) Including £574 accident insurance fund. (k) Not including 10 miles 3 chains single track lines leased. (l) Including £1,000 Insurance Fund. † Reports inserted for the financial year 1912-13.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Working Expenses.					Gross Profit on Working.	Additions to Gross Profit	Deductions from Gross Profit.						Net Surplus + or Deficit −
	Traffic.	General.	Repairs & Maintenance.	Power.	Total.			Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal	Sundries.	Total.	
Aberdeen	19,738	8,682	5,740	6,809	**40,969**	36,211	365	7,561	4,519	...	19,886	214	32,180	+ **4,396**
Accrington	7,594	2,124	1,851	4,235	**15,794**	10,427	...	4,132	3,599	49	...	...	7,780	+ **2,646**
Ashton-und'r-Lyne	4,699	1,715	2,358	3,225	**11,997**	9,894	...	2,814	3,536	440	750	†1,004	8,544	+ **1,350**
Ayr	3,403	1,959	1,383	1,925	**8,670**	7,082	...	2,100	1,669	132	1,966	128	5,995	+ **1,249**
Birmingham	108,702	37,152	46,058	75,645	**267,557**	172,543	3,774	50,014	29,270	...	...	986	80,270	+ **98,047**
Blackburn	14,863	4,262	12,392	10,999	**42,516**	24,167	110	5,292	14,909	206	...	...	20,407	+ **3,870**
Blackpool	14,325	4,758	12,889	8,262	**40,234**	25,106	...	(h) 8,721	6,332	...	5,053	...	20,106	+ **5,000**
Bolton	28,768	8,846	17,683	20,483	**75,780**	56,366	1,492	(h) 13,051	16,904	...	16,659	146	46,760	+ **11,098**
Bradford	76,831	22,521	36,739	44,044	**180,135**	109,200	3,279	20,965	31,144	2,894	30,783	4,693	90,479	+ **22,000**
Brighton	13,723	4,333	14,127	8,878	**41,061**	12,967	137	7,897	5,043	...	137	...	13,077	+ **27**
Burnley	16,918	6,395	7,474	14,738	**45,525**	27,184	...	5,786	6,327	911	...	(f) 2,394	15,418	+ **11,766**
Burton-on-Trent	4,845	3,039	616	3,295	**11,795**	4,371	...	1,423	1,378	...	500	773	4,074	+ **297**
Bury	14,761	4,349	6,633	8,026	**33,769**	33,885	337	(h) 7,974	4,824	244	...	(w) 11,608	24,650	+ **9,572**
Chester	3,278	1,598	828	2,248	**7,952**	4,868	95	(h) 2,773	1,018	...	1,172	...	4,963	...
Chesterfield	2,712	1,166	1,469	2,019	**7,366**	4,839	219	2,426	1,799	...	...	...	4,225	+ **833**
Colchester	2,771	1,134	1,584	2,486	**7,975**	2,759	56	(h) 2,273	2,235	...	...	...	4,508	− **1,693**
Croydon	27,695	6,641	11,400	15,914	**61,650**	32,780	807	8,046	7,428	809	...	...	16,283	+ **17,304**
Darlington	4,029	705	1,790	1,985	**8,059**	3,365	105	2,097	1,967	108	316	...	4,488	− **1,018**
Darwen	3,448	754	2,627	2,232	**9,061**	5,710	111	2,314	2,186	...	1,050	...	5,550	+ **271**
Derby	F 16,132 H 558	2,434 ...	4,428 55	9,026 ...	**32,020** **613**	15,343 def. 188	266	6,944	3,274	...	...	(l) 208	10,426	+ **5,183**
Doncaster	4,071	940	4,325	3,918	**13,254**	4,415	186	2,744	1,309	...	107	441	4,601	...
Dundee	16,160	4,963	7,262	10,999	**39,384**	23,296	...	8,635	5,950	217	6,902	546	22,250	+ **1,046**
East Ham	16,218	6,024	10,014	9,415	**41,671**	16,339	...	(h) 5,846	6,555	...	517	85	13,003	+ **3,336**
Exeter	4,571	1,429	1,231	3,643	**10,874**	6,416	...	2,384	1,749	16	...	...	4,149	+ **2,267**
Gloucester	6,346	1,593	2,358	1,991	**12,288**	4,714	...	4,813	2,218	...	...	...	7,031	− **2,317**
Halifax	25,150	6,073	14,705	16,962	**62,890**	39,003	...	10,381	10,196	...	13,214	405	34,196	+ **4,807**
Ilford	8,930	2,010	4,838	4,664	**20,442**	9,124	557	4,315	4,725	...	641	...	9,681	...
Ilkeston	2,359	579	1,613	1,476	**6,027**	662	157	1,578	1,644	..	...	210	3,432	− **2,613**
Ipswich	7,839	1,613	3,585	3,824	**16,861**	6,078	...	3,691	2,024	...	117	69	5,901	+ **176**
Keighley	2,769	724	940	1,551	**5,984**	3,855	224	1,160	1,815	...	...	(m) 1,104	4,079	...
Kilmarnock	3,271	774	988	1,754	**6,787**	1,850	7	(h) 1,637	1,238	2	1,160	...	4,037	− **2,180**
Kirkcaldy	4,741	1,474	1,324	2,436	**9,975**	6,090	...	2,695	1,551	...	409	111	4,766	+ **1,324**
Lancaster	2,289	505	916	1,694	**5,404**	306	92	1,352	1,425	...	...	...	2,777	− **2,379**
Leith	9,057	2,439	3,588	3,147	**18,231**	16,462	86	(h) 6,566	7,750	...	...	139	14,455	+ **2,093**
Leyton	(p) 16,573	5,056	8,211	11,672	**41,512**	21,156	...	10,340	7,596	...	1,478	264	19,678	+ **1,478**
Lincoln	1,487	615	1,054	926	**4,082**	2,732	8	1,529	1,071	...	...	...	2,600	+ **140**
Liverpool	167,045	58,771	80,184	113,893	**419,893**	224,281	24,045	50,096	59,155	...	(d) 66,929	(e) 5,217	181,397	+ **66,929**
Lowestoft	3,285	796	2,115	2,813	**9,009**	1,789	..	(h) 2,261	1,562	...	...	350	4,173	− **2,384**
Maidstone	2,324	1,077	1,139	1,868	**6,408**	3,389	58	(h) 2,797	2,185	...	...	74	5,056	− **1,609**
Manchester	240,016	81,312	81,353	127,388	**530,069**	326,720	13,963	56,724	50,856	7,413	110,604	30,086	255,683	+ **85,000**
Nelson	2,241	587	1,689	1,965	**6,482**	2,930	...	993	938	...	...	...	1,931	+ **999**
Newport (Mon.)	9,900	3,230	5,882	7,516	**26,528**	10,654	904	6,145	4,074	...	...	...	10,219	+ **1,339**
Nottingham	41,707	14,419	17,775	32,261	**106,162**	56,436	...	14,970	19,303	...	...	...	34,273	+ **22,163**
Oldham	25,086	6,931	17,077	22,090	**71,184**	30,915	1,369	15,448	11,501	1,636	...	(k) 6,112	34,697	− **2,413**
Perth	3,795	680	450	1,347	**6,272**	3,829	45	2,332	2,006	2	640	51	5,031	− **1,157**
Plymouth	7,933	3,542	5,029	7,577	**24,081**	13,832	1,258	4,778	3,931	...	3,354	...	12,063	+ **3,027**
Pontypridd	5,307	1,469	6,611	3,656	**17,043**	6,123	5	(h) 4,293	4,034	...	590	41	8,958	− **2,830**
Rawtenstall	5,292	2,216	2,049	3,958	**13,515**	11,566	(q) 1,663	6,148	5,531	...	...	...	11,679	+ **1,550**
Rochdale	16,421	4,475	6,944	9,527	**37,367**	35,635	246	11,380	9,594	694	...	(z) 7,727	29,395	+ **6,486**
Rotherham	8,991	2,539	5,187	8,497	**25,214**	10,643	944	4,393	2,757	...	3,707	...	10,837	+ **750**
Salford	67,947	16,384	24,721	47,166	**156,218**	97,814	5,158	19,550	23,846	2,295	9,569	(k) 29,712	84,972	+ **18,000**
Southampton	17,703	4,879	8,782	12,454	**43,818**	22,291	6,099	6,779	6,578	574	...	488	14,419	+ **13,971**
Southend-on-Sea	8,046	2,260	3,534	6,187	**20,027**	14,891	4,228	(h) 3,835	1,753	...	4,017	...	9,605	+ **9,514**
Southport	4,754	2,016	1,963	3,357	**12,090**	7,469	6,421	6,422	4,966	...	1,997	40	13,425	+ **465**
South Shields	7,642	3,002	2,471	5,311	**18,426**	14,506	274	(h) 5,615	3,501	...	...	...	9,116	+ **5,664**
Staly'dge, H., M., D.	13,716	4,839	5,669	6,079	**30,303**	9,260	...	(h) 7,948	7,095	...	173	516	15,732	− **6,472**
Stockport	12,436	3,717	6,437	4,781	**27,371**	33,468	1,326	5,978	8,363	910	6,795	3,208	25,254	+ **9,540**
Sunderland	18,517	5,181	4,503	10,754	**38,955**	29,279	408	(h) 7,263	9,880	271	6,818	455	24,687	+ **5,000**
Wallasey	16,074	4,027	5,281	12,979	**38,361**	19,746	474	6,270	4,383	...	2,500	633	13,786	+ **6,434**
Walsall	7,155	3,034	4,126	3,913	**18,228**	13,201	1,334	5,164	3,577	415	368	1,119	10,643	+ **3,892**
Walthamstow	13,413	2,547	5,204	7,423	**28,587**	10,403	210	(h) 6,214	2,599	...	...	...	8,813	+ **1,800**
Warrington	5,318	1,547	3,252	3,315	**13,432**	8,241	63	2,689	3,159	...	...	...	5,848	+ **2,456**
West Ham	49,252	12,386	20,005	22,055	**103,698**	36,417	979	20,154	12,289	444	426	...	33,313	+ **4,083**
Wigan	15,468	5,227	9,664	10,837	**41,196**	26,374	95	(h) 14,575	12,269	...	...	3,714	30,558	+ **4,088**
Wolverhampton	12,184	3,891	7,273	6,300	**29,648**	22,611	(x) 890	7,924	4,990	200	3,882	9	17,005	+ **6,496**
Yarmouth (Gt.)	7,482	1,835	2,968	4,031	**16,316**	8,584	110	(h) 4,014	2,699	...	1,250	113	8,076	+ **618**

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast	68,080	12,678	28,395	20,190	**129,343**	113,725	750	39,647	24,554	1,082	13,000	3,359	81,642	+ **32,833**
Bexley	(s) 5,465	984	1,892	920	**9,261**	6,107	...	2,942	2,325	...	500	...	5,767	+ **340**
Birkenhead	15,706	4,055	10,609	9,232	**39,602**	24,049	...	11,626	9,502	143	2,479	299	24,049	...
Bournemouth	22,385	7,624	11,045	13,787	**54,841**	36,814	838	10,852	15,521	...	...	(e) 7,900	34,273	+ **3,379**
Cardiff	37,145	(c) 10,512	14,894	17,223	**79,774**	65,150	1,529	24,327	23,079	750	6,947	...	55,103	+ **11,576**
Glasgow	295,525	116,405	125,844	44,866	**582,640**	408,435	49,772	75,092	93,864	13,028	213,704	10,452	406,140	+ **52,067**
Huddersfield	24,351	5,803	17,989	9,096	**57,239**	47,363	6,458	(h) 11,522	10,139	1,426	17,780	15	40,882	+ **12,939**
Hull	43,701	12,183	31,384	10,676	**97,944**	54,842	1,193	15,236	11,335	1,433	...	(a) 6,920	34,924	+ **21,111**
Leeds	103,155	31,210	38,235	24,914	**197,514**	197,807	6,270	42,613	52,931	4,879	37,314	(y) 5,176	142,913	+ **61,164**
Leicester	47,876	9,497	22,023	15,633	**95,029**	52,642	2,512	23,252	12,095	1,939	7,668	...	44,954	+ **10,000**
London	H 28,811 E 696,620	4,371 (r) 188,382	7,782 295,669	(m) 32,694 167,639	**73,658** **1,348,310**	def. 11,966 946,179	... 29,440	334,173	369,356	22,858	138,152	(l) 26,529	891,068	+ **84,551**
N'castle-on-Tyne	60,663	17,730	29,951	(g) 13,668	**122,012**	104,622	3,598	30,972	39,314	2,697	8,427	(j) 13,368	94,778	+ **13,442**
Northampton	6,774	1,886	2,237	3,496	**14,393**	13,092	845	(h) 3,637	4,206	244	1,776	(b) 874	10,737	+ **3,200**
Portsmouth	28,392	9,780	9,225	4,482	**51,879**	60,723	2,677	20,798	17,458	1,109	8,694	1,273	49,332	+ **14,068**
Preston	10,630	5,144	5,847	2,351	**23,972**	16,675	...	4,324	4,749	...	...	1,361	10,434	+ **6,241**
Reading	8,518	3,545	4,307	3,246	**19,616**	14,654	...	6,626	4,662	162	...	...	11,450	+ **3,204**
Sheffield	108,738	25,139	38,542	24,188	**196,607**	144,397	3,129	40,960	41,527	3,705	25,411	2	111,605	+ **35,921**
Wellington, N.Z.	53,887	7,505	23,067	15,451	**99,910**	38,800	978	20,320	4,794	...	17,489	...	42,603	− **2,825**

(a) Includes £4,393 loss on motor omnibuses. (b) Includes £537 loss on omnibus account. (c) Includes £1,570 insurance fund. (d) Includes reserve. (e) Rents for leased lines. (f) £2,061 rent of leased lines. (g) Including street lighting. (h) Including income tax. (i) Accrued interest. (j) Including £12,250 commuted payment to Newcastle Electric Supply Company. (k) Includes rents of lines. (l) Including loss on horse traction. (m) Horsing expenses. (n) Transferred to motor omnibus capital account. (o) Including £9,612 for lighting generation. (p) Includes £243 horse account. (q) Aid from rates £1,500. (r) Including special charges, £17,478. (s) Including £2,128 through-running expenses. (w) Amount apportioned to leased lines. (x) Includes £191 profit on motor char-a-banc. (y) Includes rent of Morley Light Railway, rotary converter, and new brakes. (z) Includes £4,386 rent of leased lines. † This item includes £734 payable to Sinking Fund of Hurst U.D.C.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Appropriation of Net Surplus.			Receipts per Car Mile.		Operating Expenses per Car Mile.					Percentage of Operating Expenses to Total Revenue.	Average Operating Expenses per Car Mile (excludi'g Power Cost).	Board of Trade Units.		
	Carried Forward.	Reserve.	Contribution to Rates or Municip'l Funds.	Average Total per Car Mile. d.	Average Traffic per Car Mile. d.	Traffic. d.	General. d.	Repairs and Maintenance. d.	Power. (Price paid) d.	Total. d.	%	d.	Units.	Cost per Unit. d.	Units used per car mile.
Aberdeen ...	...	4,396	...	11·27	11·12	2·888	1·268	·870	·994	5·98	53·08	4·986	1,893,077	·86	1·152
Accrington ...	...	2,489	...	12·05	11·84	3·49	·86	·96	1·95	7·126	60·23	5·31	1,075,437	1·20	1·60
Ashton-u-Lyne	...	...	1,350	11·475	11·186	2·463	·899	1·236	1·691	6·289	54·801	4·598	619,289	1·25	1·353
Ayr...	..	...	1,249	9·79	9·38	2·11	1·21	·86	1·19	5·39	55	4·19	374,296	1·24	·97
Birmingham ...	...	50,000	46,047	11·199	11·045	2·996	·887	1·099	1·925	6·907	60·7	4·982	14,191,012	1·2432	1·51
Blackburn ...	3,870	...	...	14·02	13·34	3·12	·90	2·61	2·31	8·94	56·84	6·63	2,030,535	1·3	1·81
Blackpool ...	...	...	5,000	16·63	16·37	3·65	1·21	3·28	2·10	10·24	61·57	8·14	1,238,641	1·60	1·31
Bolton	598	...	10,500	11·364	11·279	2·474	·761	1·521	1·761	6·517	57·778	4·752	4,468,961	1·1	1·601
Bradford	...	...	22,000	12·211	11·600	3·398	·700	1·320	1·545	6·963	62·259	5·418	10,574,643	1	1·830
Brighton	27	...	...	11·384	10·987	2·891	·914	2·976	1·871	8·652	76	6·781	1,775,559	1·2	1·56
Burnley	...	4,466	7,300	12·610	12·566	2·934	1·109	1·296	2·556	7·895	62·74	5·32	2,855,006	1·24	2·05
Burton-on-Trent	297	...	...	8·80	8·07	2·64	1·65	·33	1·80	6·42	77·75	4·88	572,569	1·38	1·13
Bury	...	(i) 4,572	5,000	10·22	10·04	2·214	·685	1·152	1·290	5·341	49·91	4·051	2,039,011	·94	1·271
Chester	...	...	...	8·84	8·51	2·26	1·10	·57	1·55	5·48	62	3·93	397,691	·764	1·14
Chesterfield ...	...	833	...	10·10	9·69	2·24	·96	1·22	1·68	6·1	59·6	4·43	387,704	1·25	1·3
Colchester ..	...	...	...	7·959	7·625	2·055	·84	1·174	1·844	5·913	73·95	4·069	397,795	1·50	1·23
Croydon	...	9,304	8,000	9·234	9·049	2·791	·671	1·139	1·556	6·157	64·73	4·474	2,287,566	1·554	·929
Darlington ...	...	...	...	7·488	7·246	2·540	·444	1·129	1·252	5·365	71·66	4·113	476,444	1	1·252
Darwen	271	...	...	14·18	13·9	3·645	·708	2·224	2·507	9·084	61·3	6·55	421,503	1·313	1·68
Derby	5,183	...	...	E 9·79 H. 5·70	9·50 5·47	3·33 7·49	·50 ...	·92 ·74	1·87 ...	6·62 8·23	67·60 144·21	4·75 ..	1,480,150	1·50&1·45 ...	1·274 ...
Doncaster ...	...	...	...	8·49	8·29	1·94	·44	2·06	1·86	6·30	75·1	4·44	683,855	1·375	1·35
Dundee	...	46	1,000	11·263	10·980	2·904	·891	1·306	1·976	7·077	61·9	5·10	2,356,993	1·125	1·764
East Ham ...	.	...	...	10·39	10·26	2·90	1·08	1·79	1·69	7·46	71·8	5·77	1,995,635	1·125	1·49
Exeter	...	2,267	...	9·653	9·653	2·552	·798	·687	2·034	6·071	62·89	4·037	537,997	1·625	1·251
Gloucester ...	...	...	...	6·694	6·258	2·498	·627	·929	·784	4·838	72	4·054	472,359	1	·77
Halifax	...	...	4,807	11·630	11·515	2·871	·693	1·678	1·936	7·178	62	5·242	3,563,953	1·125	1·69
Ilford	..	...	...	9·356	9·186	2·826	·636	1·531	1·476	6·469	69·2	4·923	994,999	1·125	1·31
Ilkeston	...	...	...	6·73	6·57	2·36	·58	1·63	1·49	6·06	90·25	4·57	339,920	1·042	1·4
Ipswich	176	...	...	8·306	8·096	2·838	·584	1·299	1·384	6·105	73·50	4·721	667,441	1·375	1·007
Keighley	...	...	...	9·721	9·473	2·736	·715	·929	1·532	5·912	61	4·380	248,096	1·5	1·021
Kilmarnock ...	...	...	...	6·709	6·525	2·541	·601	·769	1·362	5·273	78·6	3·911	336,801	1·25	1·09
Kirkcaldy ...	1,324	...	...	8·152	7·908	2·406	·748	·672	1·236	5·062	64	3·82	668,134	·875	1·413
Lancaster ...	...	...	...	7·55	7·87	3·105	·681	1·246	2·298	7·33	93	5·03	239,119	1·7	1·35
Leith	2,093	...	...	8·72	8·51	2·28	·61	·91	·78	4·58	52·54	3·8	863,202	·875	·9
Leyton	1,478	...	...	10·365	10·142	(c) 3·143	·964	1·417	1·711	7·235	66·241	5·524	2,542,672	1·078	1·587
Lincoln	140	...	...	10·12	9·92	2·20	·92	1·56	1·37	6·05	59·8	4·68	184,710	1·25	1·098
Liverpool ...	...	...	66,929	12·03	12·28	3·184	1·120	1·529	2·171	8·004	63·6	5·833	...	...	...
Lowestoft ..	...	...	...	8·3	8·3	2·5	·6	1·6	2·18	6·9	83·40	4·8	385,731	1·75	1·2
Maidstone ..	...	...	...	8·19	7·77	1·942	·900	·952	1·55	5·344	69	3·79	358,616	1·25	1·25
Manchester ..	...	...	85,000	11·375	11·225	3·187	1·079	1·080	1·691	7·037	61·87	5·346	29,890,427	1·023	1·653
Nelson	999	...	...	11·38	11·34	2·71	·71	2·04	2·38	7·84	69	5·46	235,288	2	1·19
Newport (Mon.)..	...	(h) 1,339	...	9·678	9·464	2·577	·840	1·532	1·956	6·905	71·40	4·949	1,389,504	1·25	1·51
Nottingham ...	...	4,163	18,000	11·22	11·06	2·34	1·56	1·20	2·22	7·32	65·29	5·10	6,039,203	1·25	1·73
Oldham	...	..	...	12·616	12·515	3·100	·857	2·110	2·729	8·796	69·72	6·067	3,541,360	1·375	1·823
Perth	...	...	...	8·88	8·46	3·59	·64	·43	1·27	5·93	59	4·04	289,473	1·083	1·17
Plymouth ..	...	...	3,027	11·253	11·007	2·346	1·041	1·488	2·247	7·122	63·52	4·875	1,087,297	1·672	1·34
Pontypridd ...	...	...	...	10·92	10·78	2·71	·75	3·37	1·87	8·70	80·65	6·83	701,941	1·25	1·49
Rawtenstall ...	...	1,550	...	11·16	10·71	2·35	·98	·92	1·76	6·01	53·54	4·25	687,821	1·381	1·27
Rochdale... ..	6,486	...	...	11·020	10·966	2·479	·691	1·067	1·533	5·770	51·2	4·237	2,250,037	1·016	1·503
Rotherham ...	...	...	750	11·950	11·906	2·996	·846	1·729	2·832	8·403	70·32	5·571	1,359,602	1·5	1·88
Salford	...	...	18,000	10·497	10·494	2·807	·677	1·022	1·949	6·455	62	4·506	9,137,678	1·238	1·58
Southampton ...	8,971	...	5,000	10·672	10·307	2·857	·788	1·418	2·010	7·073	66·3	5·063	1,874,217	1·625	1·266
Southend-on-Sea	2,514	1,000	6,000	13·14	12·97	3·03	·85	1·33	2·33	7·54	57·35	5·21	848,538	1·75	1·33
Southport ...	...	...	...	10·294	10·115	2·502	1·06	1·033	1·767	6·363	61·8	4·596	522,972	1·5	1·182
South Shields ...	(d) 500	5,164	...	9·710	9·483	2·253	·885	·729	1·566	5·433	55·95	3·867	904,332	1·4094	1·111
Stalybridge, &c.	...	...	...	7·640	7·569	2·649	·934	1·095	1·174	5·852	76·34	4·678	1,947,561	·75	1·567
Stockport .		540	9,000	10·434	10·221	2·133	·638	1·103	·820	4·694	44·99	3·874	1,704,943	1·036	1·218
Sunderland ...	...	...	5,000	10·917	10·859	2·962	·829	·721	1·721	6·233	56·32	4·512	1,720,607	1·5	1·14
Wallasey ...	234	(f) 200	6,000	11·357	11·207	3·142	(g) ·787	1·032	2·563	7·497	66	4·96	1,916,450	1·625	1·56
Walsall	3,392	...	500	11·326	11·038	2·578	1·034	1·487	1·410	6·569	58	5·159	780,825	1·25	1·172
Walthamstow ..	1,800	...	...	9·31	9·13	3·20	·61	1·24	1·77	6·82	73·32	5·05	1,188,326	1·5	1·18
Warrington ...	338	618	1,500	11·727	11·545	2·877	·837	1·760	1·794	7·268	61·796	5·474	530,436	1·5	1·196
West Ham ...	...	4,083	...	10·44	10·33	3·659	·904	1·461	1·609	7·633	72	6·024	5,571,743	·95	1·69
Wigan	...	...	...	11·206	11·007	2·565	·866	1·603	1·798	6·832	60·97	5·03	2,190,122	1·187	1·52
Wolverhampton	...	2,719	3,777	10·967	10·798	2·557	·817	1·526	1·322	6·222	56·73	4·90	1,508,410	1	1·319
Yarmouth (Gt.)...	618	..	...	8·962	8·775	2·695	·660	1·067	1·450	5·872	66·92	4·422	643,282	1·50	·964

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

									*					Works Cost.	
Belfast	...	...	32,833	10·29	10·12	2·88	·54	1·20	·85	5·47	53·21	4·62	7,734,501	·626	1·36
Bexley	40	..	...	12·8	12·63	3·04	·89	1·75	·87	6·55	60·3	5·68	350,103	·63	1·37
Birkenhead ...	...	...	...	11·77	11·609	3·075	·793	2·076	1·166	7·110	60·37	5·98	2,454,214	·561	2·002
Bournemouth ...	...	3,379	...	11·92	11·89	2·91	·99	1·44	(b) 1·79	7·13	59·83	5·34	2,743,998	·576	1·48
Cardiff	6,926	...	4,650	13·45	11·65	3·446	·976	1·382	·634	6·438	55	5·804	3,864,260	·415	1·49
Glasgow	...	...	52,067	10·602	10·561	3·162	1·245	1·346	·480	6·233	55·98	5·753	30,261,134	·355	1·35
Huddersfield ...	6,481	...	6,458	11·18	10·85	2·60	·62	1·93	·97	6·12	54·72	5·15	5,120,215	·65	2·22
Hull	...	9,111	12,000	9·75	9·65	2·81	·78	2·00	·68	6·27	63·72	5·47	4,728,903	·55	1·26
Leeds	...	...	61,164	11·125	11·008	2·903	·878	1·076	·700	5·557	49·96	4·857	15,716,216	·380	1·778
Leicester	...	...	10,000	9·675	8·843	3·137	·622	1·443	1·024	6·226	64	5·202	6,558,800	·3645	1·79
London	...	H.84,551	...	H. 8·81 E. 11·29	8·62 10·98	4·12 3·42	·62 ·93	1·11 1·45	4·67 ·83	10·52 6·63	119·40 58·76	10·52 5·80	... 122,307,298	... ·61	... 2·51
N'castle-on-Tyne	...	...	13,442	11·841	11·317	3·170	·926	1·565	(a) ·714	6·375	52·23	5·661	8,745,068	·356	1·904
Northampton ...	...	1,200	2,000	10·11	9·85	2·51	·67	·82	1·29	5·29	52	4·00	1,032,199	·81	1·58
Portsmouth ...	8,068	(f) 2,000	4,000	12·261	12·069	3·092	1·065	1·004	·488	5·649	46·08	5·161	2,583,580	·448	1·041
Preston	...	6,241	...	10·415	10·34	2·724	1·319	1·499	·602	6·144	59·22	5·542	1,377,176	·409	1·236
Reading	...	1,344	1,860	8·968	8·676	2·229	·928	1·127	·849	5·133	57	4·28	955,400	·815	·90
Sheffield	...	2,000	33,921	10·601	10·501	3·380	·782	1·198	·752	6·112	57·655	5·360	15,603,810	·642	1·784
Wellington, N.Z.	...	...	...	14·615	14·666	5·698	·793	2·439	1·634	10·564	72·03	8·93	4,873,707	·765	2·14

H—Horse lines. E—Electric trolley system. * The figures given under "Power" in Table II. include actual works costs only. (a) Including power and street lighting. (b) Including ·93d. per car mile current supplied by Bournemouth and Poole Supply Company. (c) Horse account ·050d. (d) Accident, insurance, and compensation fund. (e) Total B.O.T. units, including lighting, 10,215,925. (f) Insurance fund. (g) Including ·09d. to Superannuation Fund. (h) Renewals Fund. (i) Including £1,000 Insurance Fund.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Population Served.	Car Mileage.	Passengers Carried.	Traffic Records. Passengers Carried per Car Mile.	Average Fare per Passenger. d	Average Journeys per Head of Populat'n per Annum.	Average Car Miles per Day per Car.	Traffic Revenue per Mile of Single Track. £	Average Traffic Revenue per Annum per Head of Populat'n Served.	Operating Expenses per Passenger. d.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Average Speed per Hour. Miles.	Average Total Car Hours per Day.	Average Number of Cars in Use Daily.	Number of Cars in Stock.
Aberdeen ..	165,000	1,643,247	19,054,847	11·59	·96	121·5	99·7	2,744	9/3	·516	1·7	·6	7·5	640	45	71
Accrington...	45,075	671,374	4,336,545	8·3	1·42	96·2	105	2,406	11/5	·874	1·07	·929	7·5	242	17	27
Ashton-u-L.	50,000	457,856	4,754,139	10·383	1·077	95·083	104	2,606	8/6	·606	1·223	·81	8	204	12	21
Ayr	33,000	385,796	3,739,237	9·69	·96	113	106	1,981	9/2	·556	1·25	·75	8	14	10	20
Birmingham	570,113	9,431,282	113,475,399	12·03	·9	199·04	84·53	4,278	15/3	·79	2·600	·391	7·5	10·91	330	360
Blackburn ..	200,000	1,141,161	11,721,367	10·88	1·27	58·61	105	2,564	6/4	·87	1·25	·76	7·50	434	31	61
Blackpool ..	67,000	942,829	10,339,719	11	1·36	154·4	83	3,705	19/2	·934	...	...	8	...	31	72
Bolton ..	221,000	2,792,236	29,319,812	10·50	1·073	132·669	120·66	2,790	11/10	·654	1·468	·627	7·25	1,030	60	106
Bradford ...	337,000	5,686,653	56,352,281	9·91	1·168	167	113·72	2,717	16/3	·787	1·60	·514	7·3	2,123·5	137	239
Brighton ..	131,444	1,139,048	11,382,406	10	1·10	86·6	91·76	3,033	7/11	·865	1·27	·788	6·41	544	34	50
Burnley ..	170,000	1,383,822	14,468,231	10·46	1·19	85	100	3,450	8/6	·755	1·25	·83	7	764	36	57
Burton ..	48,000	440,941	3,300,252	7·48	1·078	69	...	1,734	6/9	·86	1·35	·69	7·5	...	...	20
Bury	128,202	1,599,872	15,132,553	9	1·07	118·03	102·33	1,957	10/6	·535	1·24	·85	8·56	506·64	42·71	50
Chester ..	39,038	347,904	3,078,564	8·85	·96	2·34	95	1,944	6/4	·622	1·27	·8	7	150·6	10·04	18
Chesterfield	38,000	289,890	2,519,533	8·69	1·1	66	132	2,249	6/5	·702	1·38	·75	7·33	117	6·5	14
Colchester ...	43,452	323,693	1,828,878	5·65	1·34	41·85	89·2	1,295	4/9	1·04	·89	1·10	6·84	149·79	10·26	18
Croydon ..	167,918	2,462,468	20,849,230	8·494	1·065	124·16	118	4,838	11/4	·710	2·206	·49	7·88	843·92	56	75
Darlington..	56,800	380,572	3,674,075	9·6	·751	64·68	94·5	1,295	4/	·556	1·098	·9	6·66	151·25	11	16
Darwen ..	40,611	249,950	2,785,037	11·1	1·17	68·5	40	2,029	7/2	·781	1·05	·78	8	115·56	6·42	17
Derby ..	124,544	E 1,161,398 H. 17,876	10,604,977 98,364	9·13 5·44	1·05 ·993	85·15	...	2,103 ...	7/5 ...	·724 1·49	1·44 1	·75 1	6·375 ..	... ...	... ...	50 ...
Doncaster ..	50,000	504,250	4,532,625	8·98	·922	90·65	115	1,479	7/-	·702	1·25	·76	7·5	221	14	25
Dundee .	165,000	1,335,512	17,022,560	12·74	·861	103	87	2,222	7/7	·555	2	·50	7·3	555	42	66
East Ham ...	133,000	1,340,252	17,789,734	13·27	·77	134	...	3,981	8/7	·56	1·63	·65	...	...	...	45
Exeter ..	48,500	429,878	4,244,671	9·87	·977	87·5	81	2,470	7/2	·615	1	1	6	224	16	20
Gloucester ..	52,795	609,531	4,111,175	6·7	·92	77	92·5	1,059	6/-	·70	1·5	·65	7·11	243	18	30
Halifax ..	176,000	2,102,757	18,749,456	8·92	1·26	107	77	1,859	11/6	·805	1·35	·84	6·8	803	73	95
Ilford ..	80,000	758,456	7,784,992	11·21	·84	97·31	130	2,560	6/10	·630	1·543	·69	8	...	16	26
Ilkeston ...	32,000	238,645	1,732,846	7·25	·9	54	117	1,713	6/1	·836	3·2	·35	7·5	108	7·5	13
Ipswich ..	74,500	662,792	5,526,496	8·33	·971	74·81	66·91	1,502	5/10	·732	1·53	·693	6·12	332·48	20·78	36
Keighley ..	42,000	242,919	2,245,120	9·242	·98	53·45	55·42	1,568	4/7	·639	2·22	·45	6·87	126	7	12
Kilmarnock	36,000	308,976	2,268,033	7·34	·88	63	90·34	1,508	4/8	·728	1·13	·86	7·22	116·5	9·37	14
Kirkcaldy ..	39,600	472,928	5,198,320	10·9	·719	131·2	52	1,771	7/11	·460	1·522	·75	7	169	16	22
Lancaster ..	41,414	176,903	1,473,987	8·33	·906	36	76	1,159	2/8	·88	1·71	·5	6	88·90	6·35	12
Leith .	81,000	954,563	9,339,324	9·7	·87	115·30	123	1,880	8/4	·46	1·32	·72	8·2	320	21·33	37
Leyton ..	124,736	1,601,833	16,897,512	10·549	·873	135	104	3,524	9/10	·590	...	...	7·70	574·56	42	60
Lincoln ..	20,000	161,897	1,712,109	10·57	·93	85·6	64·7	2,255	6/8	·572	1·75	·428	7	90	5	8
Liverpool ...	...	12,590,408	134,249,967	10·66	1·128	...	...	5,303	...	·756	2·45	...	...	...	445	587
Lowestoft ...	35,000	308,897	2,462,188	8	1·05	70·35	...	2,646	6/2	·878	univ'rs'l penny fare		...	...	..	19
Maidstone ...	25,000	287,179	2,096,488	7·3	1·062	83·85	70	1,319	7/5	·73	1	1	6·7	128	12	19
Manchester	950,000	18,076,999	174,424,237	9·65	1·16	184	97·2	4,892	17/10	·729	2·293	·435	8·24	...	508	617
Nelson ...	45,000	198,414	2,509,514	12·65	·89	55·77	90·35	2,425	4/2	·619	1	1	5·50	108	6	9
Newport ...	85,634	922,064	8,937,257	9·69	·998	104·4	109	2,518	8/6	·488	1/4·68	·66	6·77	18½	27	44
Nottingham	260,000	3,476,262	36,026,471	10·36	1·06	138	95·74	4,388	12/4	·70	1·68	·65	6·86	...	100	135
Oldham ...	180,000	1,942,147	20,073,483	10·335	1·19	111·51	106·5	2,796	11/3	·851	1·12	·884	6·56	800	50	92
Perth... ...	35,900	253,851	1,861,145	7·33	1·15	51·84	96·25	1,892	5/5	·72	...	...	6·25	120	8	12
Plymouth ...	112,000	809,036	8,666,269	10·71	1·026	77·377	93·5	...	6/8	·667	...	...	...	25·5	...	42
Pontypridd...	40,000	470,215	4,721,110	10·04	1·07	118	83·4	2,457	10/7	·77	1·25	·51	6·5	234	18	26
Rawtenstall	30,516	539,320	4,669,522	8·66	1·24	93·39	123	1,515	15/9	·69	1·12	·88	9	16½	12	22
Rochdale ...	130,000	1,589,866	12,711,114	7·99	1·35	97·7	114·90	1,825	11/2	·76	1·07	·90	7·66	645	43	69
Rotherham...	64,000	720,133	7,813,922	10·85	1·097	122·1	116	2,977	11/2	·774	1·5	1	12	19	20	36
Salford ..	350,000	5,808,369	48,720,788	8·38	1·30	139	114	3,386	14/6	·76	1·85	·55	7·96	2,135	140	200
Southampt'n	122,200	1,486,746	12,348,658	8·306	1·241	101	...	3,592	10/5	·85	...	...	...	...	...	68
Southend ...	78,000	637,366	7,581,104	11·89	1·09	97·2	87	4,708	8/10	·634	1·41	·76	...	...	...	31
Southport ...	33,792	455,967	4,371,296	9·586	1·05	129·3	103·8	1,770	11/4	·66	1·6	·619	6·6	204	14·3	26
So'th Shields	108,649	813,947	8,032,488	9·868	·957	73·9	129·2	3,138	5/2	·555	1·825	·54	7·61	282	16	35
Stalybridge	92,585	1,242,777	10,256,918	8·253	·907	110·5	...	1,445	8/5	·709	1·275	·784	6·8	...	...	60
Stockport	120,000	1,399,314	10,665,098	7·6	1·341	88·8	76·6	2,158	9/11·3	·615	1·25	·72	7·5	465	38	50
Sunderland	170,000	1,500,015	16,783,776	11·1	·970	98·7	79·4	3,335	8/-	·550	1·34	·68	7	672	42	70
Wallasey ...	81,000	1,227,935	11,459,807	9·33	1·20	141·48	98·6	2,887	14/2	·803	1·99	·52	7	590	42	55
Walsall ...	100,000	665,964	5,683,798	8·535	1·293	87	57	1,750	6/1	·769	1·24	·77	7	315	21	39
Walth'mst'w	126,000	1,004,872	12,049,323	11·99	·762	95·63	97	3,052	6/1	·569	1·15	·89	7·2	408	36	38
Warrington	86,000	443,560	5,647,137	12·731	·907	65·664	102·15	2,251	4/11	·57	1·246	·803	6·384	189·84	11·865	21
West Ham..	291,900	3,287,917	41,017,938	12·47	·827	140	92	5,089	9/10	·61	1·79	·57	7·33	1,255·5	93	118
Wigan ...	200,000	1,447,048	12,112,333	8·37	1·314	65·6	96	2,140	6/7	·816	1·47	·9	7·4	800	40	67
Wolverh'ton	135,000	1,143,542	11,253,196	9·84	1·09	83·36	87	2,393	7/7	·626	1·149	·923	6·85	612	36	49
Yarmouth ...	52,000	666,793	4,633,251	6·95	1·265	12·823	73·07	1,681	9/4·5	·845	1·25	·76	7	375	25	35

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast ...	385,492	5,671,776	54,546,856	9·62	1·05	141	128	3,107	12/5	·57	1·96	·43	8·75	1,776	(b) 224	250
Bexley ..	16,000	262,658	2,130,189	8·11	1·56	133	...	2,360	18/11	·95	1·37	·62	7·5	...	8	16
Birkenhead	130,832	1,225,544	13,273,858	10·83	1·072	101·46	68·96	2,461	9/1	·716	1·39	·70	6·61	494·48	48·55	59
Bournem'uth	120,000	1,844,507	15,121,935	8·09	1·45	126	84·23	3,069	15/3	·87	1·19	·87	6·80	820	60	81
Cardiff ...	182,729	2,586,421	27,561,652	10·66	1·09	151	98·5	3,947	13/9	·69	1·44	·736	7·5	1,104	69	130
Glasgow	1,150,000	22,435,076	275,610,385	12·285	·860	239·66	105·29	5,037	17/2	·507	2·31	·44	8·13	8,150·63	582·19	808
Huddersfield	150,000	(a) 2,245,427	20,471,968	9·15	1·13	136	118	3,487	13/7	·67	1·31	·71	7·41	828·96	51·81	86
Hull	282,987	3,761,809	41,277,202	10·97	·87	148·06	123·82	5,117	10/8	·564	2·75	·36	9	1,328·16	83·01	151
Leeds ...	500,000	8,527,957	86,021,943	10·08	1·089	172·04	113·29	3,530	16/7	·932	1·95	·539	7·45	3,135	209	236
Leicester ...	229,296	3,663,215	32,907,795	8·983	·981	143	95	3,648	11/9	·693	2·18	·984	8	18	107	140
London ...	...	H 1,680,786 E 48,777,026	17,347,746 516,092,489	10·32 10·58	·84 1·04	... ...	83 113	2,646 8,732	... ...	1·019 ·627	... ...	... ...	6·15 8·44	742·5 15,786·8	55 1,179	96 1,584
Newcastle ...	300,000	4,593,419	49,348,688	10·74	1·087	164	...	3,595	14/5	·59	1·58	·633	7	...	...	186
Northampt'n	90,076	652,074	6,497,622	9·95	·98	74·38	...	2,923	5/11	·531	1·34	·7	6·91	...	...	26
Portsmouth	236,732	2,204,042	25,039,320	11·36	1·066	110	84	3,593	9/5	·497	1·66	·62	7	1,086	72	100
Preston ...	120,000	936,553	9,000,070	9·61	1·02	75	130	3,802	6/9	·639	1·01	·95	7·36	380	20	30
Reading ...	75,500	917,045	8,279,650	9·02	·97	109	97	2,505	8/9	·57	1·59	·68	7	352	26	36
Sheffield ...	455,793	7,720,026	90,458,851	11·717	·896	198·465	101·3	4,403	14/10	·522	2·5	·416	7·274	3,018·78	208·192	269
Wellington ..	68,000	2,269,840	23,262,433	11·01	1·33	342	93	4,316	42/8	·94	1·287	·76	8·01	786	68	85

E—Electric trolley system. H—Horse lines. (a) Including 8,955 miles coal haulage. (b) 123 cars all day.
(c) Includes tramway operating cost only, excludes cost bulk supply to lighting department.

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TRAMWAY AND OMNIBUS SHARE LIST.

Specially Compiled for "The Tramway and Railway World."

Amount Ranking for Dividend.	Shares.	Name.	Div'd. Prev. Half-year.	Div'd. Last Half-year.	Quotations, April 30.	Movement During April. Rise.	Movement During April. Fall.	Latest Business Done. Price.	Latest Business Done. Date.	Yield on Buying Price. £ s. d.	Dividend Due. (Final in Italics.)	Quotations, Jan., 1908, to April 30, 1913. Highest	Quotations, Jan., 1908, to April 30, 1913. Lowest
640,000	5	Anglo-Argentine Tramways 5½% Cum. 1st Pref.	2/9	2/9	4 13/16—5 1/16	...	...	5	Apr. 29	5 8 9	Jan., Dec.	5 17/32	4¼
500,000	5	Do. do. 5½% Cum. 2nd Pref.	2/9	2/9	4¾—4¾	...	...	94/4½	Apr. 26	5 15 9	June, *Dec.*	5 11/32	4 7/16
1,500,000£	...	Do. do. 5% Deb. Stock Red.	5%	5%	99—101	+ 1	...	100⅜	Apr. 30	5 0 0	June, Dec.	105½	96
325,532£	Stk.	Auckland Elec. Trys. Co. 5% Mort. Deb. ...	5%	5%	101—103	...	...	103	Apr. 28	4 18 0	Jan., July.	107	101
75,000	1	Bath Electric Tramways 5% Cum. Pref. ...	6d.	6d.	11/16—13/16	...	...	14/6	Dec. 31	6 3 3	*Jan.* & July	1 3/16	7/16
334,696£	Stk.	Birmingham Dist. Pow. & Tract. 4½% 1st Deb....	4½%	4½%	88—90	...	...	91½	Dec. 17	5 0 0	Jan., July.	96	77
15,000	10	Blackpool and Fleetwood Tramways	4/-	9/-	13⅝—14⅛	...	...	14	Mar 10	4 12 0	Feb., Aug.	14½	12
60,000	10	Bombay Elec. Supply & Trys. Co. 6% Cum. Pref.	6/-	6/-	10¾—11½	...	— ¼	11	Apr. 29	5 4 6	Feb., Aug.	12¼	7⅜
1,003,614	$100	Brazil Traction...	6	6	95½—97½	...	— 2½	96½	Apr. 30	6 6 6	Fb.My.Ag.Nv.	105¼	90¼
75,000	5	Brisbane Elec. Tramways Investment Co. Ord.	4/-	4/-	7⅛—7⅜	...	...	7 7/16	Apr. 21	5 5 0	*May*, Oct.	9½	3 3/16
75,000	5	Do. do. do. 5% Cum. Pref.	2/6	2/6	4⅞—5⅛	...	...	5⅛	Apr. 25	4 15 3	*May*, Nov.	5⅜	4⅜
50,000	10	Bristol Tramways and Carriage Co.	4	4	5¾—6¼	...	...	5⅞	Nov. 9/10	6 8 0	*Feb.*, Aug.	14¼	5
50,000	10	Do. do. do. 4% Cum. Pref.	4	4	7¼—7¾	...	...	7	Sept. 30	5 3 3	Jan., July.	9¼	6¾
800,000£	Stk.	British Columbia Electric Railway Def. Ord. ..	8%	8%	131—134	+ 3	...	132	Apr. 29	5 19 0	May, Nov.	156	123
800,000£	Stk.	Do. do. Pref. Ord.	6%	6%	113½—116½	...	— ½	113½	Apr. 26	5 8 0	Feb., Aug.	132½	105
800,000£	Stk	Do. do. 5% Cum. Perp. Pref.	5%	5%	103—106	...	...	104½	Apr. 30	4 14 9	Jan., July.	114	99
1,070,097£	Stk.	British Electric Traction Prefd. Ord.	...	...	8½—10½	...	— ½	9	Apr. 30	...	Apr., *Oct.*	16	10½
403,503£	Stk.	Do. do. 6% Cum. Pref. ...	6%	6%	84—87	...	— 1½	83¼	Apr. 30	6 18 0	Feb., *Aug.*	95¼	85½
1,464,245£	Stk.	Do. do. 5% Perp. Deb. ...	5%	5%	88—92	...	— ½	89¼	Apr. 30	5 8 9	April, Oct.	101	82½
439,796£	Stk.	Do. do. 4½% 2nd Deb. Red. ...	4½%	4½%	73—77	...	...	76	Apr. 25	5 17 0	May, Nov.	84	58
246,625£	Stk.	Buenos Aires Port & City Trys. 6% 1st Mt. Deb.	6%	6%	92—96	...	...	95	Mar. 7	6 6 6	Feb., Aug.	103	61
623,270£	Stk.	Buenos Ayres Lacroze Trys. Stg. 5% 1st Mt. Deb.	5%	5%	99—101	...	...	100⅛	Apr. 29	4 19 0	Mar., Sept.	103	89
137,610	5	Calcutta Tramways Ord.	2/6	5/-	5½—6	...	...	6	Apr. 30	6 5 0	*Apr.*, Oct.	7¼	4
47,295	5	Do. 5% Cum. Pref.	2/6	2/6	4 13/16—5 1/16	...	...	5	Apr. 17	4 18 9	Jan., July	5⅜	4⅜
491,222	1	Cape Electric Tramways	1/-	for '12	11/16—13/16	...	...	15/7½	Apr. 30	6 3 3	Feb., *Nov.*	13/16	⅛
15,000	10	Carthagena and Herrerias Steam Tramways ...	4/-	May, '12	3½—4½	+ ¾	...	65/-	Nov. 21	...	April.	7	3
248,000	5	City of Buenos Ayres Tramways (1904) ...	2/6	2/6	5 5/16—5 9/16	...	— ⅛	5 11/32	Apr. 30	4 10 0	Fe My.Au.No	6	5⅛
120,000£	Stk.	Colombo Elec. Trys. & Ltg. 5% 1st Mt. Deb. ...	5%	5%	90½—94½	...	...	96	Jan. 31	5 6 0	May, Nov.	101	87
11,500	10	Cork Electric Tramways and Lighting Co. ...	...	8/- ann.	4½—5	...	...	4 15/32	Dec. 23	2 0 0	*Mar.*	10	4½
12,327	10	Do. do. do. 5% Cum Pref.	5/-	5/-	7½—8	...	...	8	July 22	6 5 0	Jan., July	10¾	7½
3,000	10	Dublin and Lucan Elec. Railway 5% Cum. Pref.	5/-	5/-	8½—9	...	...	9	Aug. 25/10	5 11 3	Sep.15, Mar.15	9¼	6
60,000	10	Dublin United Tramways Co. (1896), Ltd., Ord.	6/-	6/-	11¼—11¾	...	...	11⅜	Apr. 22	5 2 3	Feb., Aug.	14	11
60,000	10	Do. do. do. 6% Cum. Pref.	6/-	6/-	11¾—12¾	...	...	12 1/16	Apr. 30	4 14 3	*Feb.*, Aug.	14	11½
13,500	10	Gateshead & District Trys. Co. Ord.	5/-	9/-	8½—9	...	...	8 11/16	Apr. 7	7 15 0	*Mar.*, Sept.	9¼	7⅞
268,235	10/-	Hastings and District Elec. Trys Ord.	...	...	1/32—3/32	...	...	1/9	Jan. 5/12	...	...	3/16	1/32
80,000	1	Do. do. 6% Cum. Pref. ...	6%	6%	⅝—¾	...	...	12/6	June 6	8 0 0	...	⅝	15/32
125,000£	Stk.	Do. do. 4½% Deb. Stk. Red.	4½	4½	66¾—71¾	...	...	73¼	Feb. 8/12	6 5 6	April, Oct.	100	69
$9,634,000	$1,000	Havana Elec. Rly. Co. Con. Mort. 5%	5%	5%	97—101	...	...	97 13/16	Mar. 29	5 2 0	Feb., Aug.	105	80
195,000£	100	Hong Kong Tramways Co. 5% Mt. Deb. ...	5%	5%	87—91	...	— 1	88¼	Apr. 10	5 11 3	May, Nov.	92	75½
20,000	10	Imperial Tramways Ord.	Nil	Nil	4½—5½	...	...	9¾	Oct. 29/09	...	Feb., Aug.	9¾	2¼
20,000	10	Do. 6% Cum. Pref.	Nil	Nil	8—8½	...	...	6 7/32	Ju. 28/09	...	Jan., July.	9½	2¾
30,000	5	Isle of Thanet Elec. Try. & Ltg. Co. 5% Cum. Pref.	2/6	Dec. '12	2⅛—2⅜	...	...	46/3	Nov. 30	4 15 3	*Mar.*, Sept.	3	¾
250,000	1	Kalgoorlie Electric Tramways	...	...	1/32—3/32	...	...	1/-	Jan. 15/12	...	*May*	3/16	1/32
170,000	1	La Plata Elec. Trys. Co. 6% Cum. Pref. ...	0/4·65	May, '13	15/16—1 1/16	+ 1/32	...	20/-	Apr. 26	...	*April*, Oct.	1 1/16	¼
30,800	10	Lanarkshire Tramways	5/6	6/-	9¾—10	...	...	10	May 27	5 15 0	Feb., Aug.	10 9/16	9⅜
250,000£	Stk.	Lancashire United Trys. 5% Prior Lien Deb....	5%	5%	78—80	...	...	78½	Mar. 26	6 6 9	Jan., July.	95	78½
634,026	1	Lisbon Electric Tramways Ord.	7½d.	7½d.	1 3/16—1 5/16	...	...	24/-	Mar. 10	4 11 6	*July.*	1 9/32	⅞
425,553	1	Do. do. 6% Cum. Pref ...	7½d.	7½d.	1 1/16—1 3/16	...	...	22/6	Feb. 15	5 1 3	Jan., July.	1¼	13/16
1,000,000£	Stk.	London General Omnibus 4½% 1st Deb.	...	4½	94—96	...	...	95	Apr. 29	4 14 9	Jan., July.	98	93¼
1,000,000£	Stk.	Do. do. 5% Cum. Income ...	...	5	87½—89½	...	— 1½	88½	Apr. 29	5 11 9	Feb., Aug.	94	87½
125,000	10	London United Trys. (1901), Ltd., 5% Cum. Pref.	2/6	Dec. '08	4¼—5	...	...	5⅛	Dec. 5	...	*Jan.*, July.	8½	1⅜
63,430£	Stk.	Madras Elec. Trys. (1904) Ltd. 5% Deb. Red. ...	5%	5%	103—105	+ 1	...	102¾	Mar. 7	4 16 3	Jan., July.	102¾	86
300,000£	100	Manaos Trys. & Ltg. Co. 5% 1st Debs.	5%	5%	88—91	+ 1	...	90½	Apr. 30	5 11 9	Jan., July.	97	86
$4,785,000	$1,000	Manila Elec. R. R. and Ltg. Corp. 5% Gld. Bds.	5%	5%	97—100	...	— ½	99½	Apr. 29	5 0 0	Mar., Sept.	104⅜	84
60,000	1	Mansfield & District Trys. Ltd. 6% Cum. Pref.	7½d.	7½d.	15/16—1 1/16	...	...	19/3	Sept. 5	5 13 0	Mar., Sept.	1 1/32	¾
395,832	1	Metropolitan Electric Tramways Ord.	5	6	27/32—31/32	...	— 1/16	21/3	Dec. 10	5 13 6	*April*, Oct.	1⅜	⅜
78,504	1	Do. do. do. (New)... ...	...	...	...	...	...	...	...	...	...	1 1/32	29/32
500,000	1	Do. do. do. 5% Cum. Pref.	6d.	6d.	11/16—13/16	...	...	14/-	Mar. 13	6 3 3	*Feb.*, Aug.	1 1/32	11/16
$16,487,400	$100	Mexico Tramways Common Stock	$3½	$3½	106—108	...	— 5	108½	Apr. 28	6 13 6	Fb.My.Au.No	151½	65
$3,840,000	...	Michigan Untd Rys. Co. 5% 1st Debs & Refdg Bds	5%	5%	94½—96½	+ 1½	...	96	Apr. 26	5 8 9	May, Nov.	101½	92¼
600,000£	100	Montreal Street Rly. 4½% Ster. Debs.	4½%	4½%	98—100	...	...	98½	Apr. 19	4 10 0	Fe.My.Au.No.	107	98
150,000	1	National Steam Car	2/-	year	1½—1⅝	...	...	30/9	Apr. 30	6 3 0	Dec.	39/9	29/-
5,000	10	Oldham, Ashton, and Hyde Elec. Tramways Ord.	5/-	7/-	6⅛—6⅜xd	...	— ⅛	6½	Oct. 8	9 8 3	Mar., Aug.	9⅜	6⅜
5,000	10	Do. do. do. 5% Cum. Pref.	5%	5%	6⅜—6⅝	...	...	6 17/32	July 8	7 11 0	Feb., Aug.	8¾	6¼
77,893	5	Para Elec. Rly. and Ltg. Co., Ord.	5/-	5/-	7—7½	...	...	7 1/16	Apr. 28	6 13 6	May, Nov.	8	6
100,000	1	Perth (W.A.) Electric Tramways Ord.	6d.	7½d.	1 3/32—1 11/32	...	...	25/6	Nov. 8	4 2 9	*Sept.*, Nov.	26/3	⅜
245,000	1	Potteries Electric Traction Ord.	3½	for '11	5/16—7/16	...	...	7/6	Dec. 2	8 0 0	April.	¾	⅛
245,000	1	Do. do. 5% Cum. Pref. ...	6d.	5d.	13/32—23/32	...	...	13/1½	Apr. 30	6 13 6	*Feb.*, Aug.	¾	7/16
124,560	1	Provincial Tramways Ord.	8d.	10d.	11/16—13/16	...	...	16/-	Mar. 28	9 4 3	May. *Nov.*	1 1/16	13/-
10,000	10	Do. do. 6% Cum. Pref.	6/-	6/-	9⅜—9⅝	...	...	9 9/16	Apr. 23	6 4 9	June, *Dec.*	11	9
50,000	5	Rangoon Elec. Trys. & Supply Co. 6% Cum. Pref.	3/-	3/-	5⅜—5⅞	...	...	5⅜	Apr. 26	5 2 3	June, Dec.	6	5
32,000	10	Shanghai Elec. Construction Co.	...	...	7¾—8¾	...	...	8	Nov. 28	...	May.	11½	6
330,400£	Stk.	Singapore Elec. Trys. Ltd., 5% Debs. Red. ...	5%	5%	83½—87½	...	...	85	Apr. 8	5 14 3	Mar., Sept.	89	61
169,570	1	S. Metrop'n Elec. Trys. & Ltg. Co. 6% Cum. Pref.	1/2⅜	May, '12	11/16—13/16	...	...	15/9	May 16, '12	7 7 9	Feb., Aug.	1⅛	⅜
91,720£	Stk.	Southern Elec. Trys. of B.A., 1st Mt. Deb. ...	5%	5%	96—98	+ ½	...	96	Mar. 6	5 3 3	Feb., Aug.	100	90
471,500£	100	Toronto Rly. Co. 1st Mt. 4½% Stg. Bonds ...	4½%	4½%	98—100	+ 2	...	99	Nov. 8	4 11 0	Feb., Aug.	104	97
80,000	5	United Elec. Tramways of Monte Video, Ord....	4/-	3/-	4⅞—5⅜	...	— ⅛	98/9	Apr. 29	6 10 3	*June*, Dec.	6½	4⅞
90,000	5	Do. do. do. 6% Cum. Pref.	3/-	3/-	4⅞—5⅜	...	...	5¼	Apr. 30	5 11 9	June, Dec.	6⅛	4 9/16
500,000£	Stk.	Winnipeg Elec. Rly. Co. 4½% Perp. Cons. Debs.	4½%	4½%	99—102	+ ½	...	101	Apr. 2	4 8 3	Apr., Oct.	109½	98½
40,977	5	Yorkshire (West Riding) Elec. Trys. Ord. ...	...	...	¼—¾	...	...	8/6	Oct. 31	...	*Mar.*	1½	⅜
46,261	5	Do. do. do. 6% Cum. Pref.	1/6	1/6	3¼—3¾	+ ⅜	...	71/3	Apr. 30	4 0 0	*Mar.*	3¾	1¾

ELECTRIC RAILWAY SHARES.

1,854,720£	Stk.	Central London Ord. Stock	3	3	82—84	+ 4	...	82½	Apr. 30	3 11 6	*Feb.*, Aug.	89½	59⅞
572,640£	Stk.	Do 4% Pref. Stock	4	4	84—86	+ 1	...	84½	Apr. 24	4 13 0	Feb., Aug.	92	80
572,640£	Stk.	Do. Deferred Stock	2%	for '12	80—82	+ 2	...	81¼	Apr. 26	2 8 9	Feb., Aug.	91⅜	42
78,000	10	Great Northern and City Pref. Ord. 4% ...	Nil	Nil	2¾—2⅞	...	...	47/6	Mar. 14	...	*Feb.*, Aug.	2⅞	⅛
50,000	10	Liverpool Overhead Ord.	2/-	2/6	3¾—3⅞	+ 3/16	...	75/7½	Apr. 20	5 16 3	*Feb.*, Aug.	4	⅜
1,412,263£	Stk.	Mersey Cons. Ord. Stock	Nil	Nil	5¼—5¾	+ ¼	...	5	Apr. 17	...	*Feb.*, Aug.	8	1
5,732,062£	Stk.	Metropolitan Cons.	1½	1¾	50¾—51¼	...	— 1½	50¾	Apr. 30	3 3 6	*Feb.*, Aug.	75⅛	34
2,640,914£	Stk.	Do. Surplus Lands Stock	2¾	2¾	62—64	...	...	62½	Apr. 26	4 6 0	*Feb.*, Aug.	72	60¾
3,235,000£	Stk.	Metropolitan District Ord.	Nil	Nil	38¾—39¼	+ 2⅛	...	39	Apr. 30	...	*Feb.*, Aug.	51½	9½
467,000	10	Underground Electric Railways Co. of London	...	...	3⅞—4⅛	...	— ⅜	81/3	Apr. 30	...	...	5 9/16	1⅜
1,730,000£	...	Do. 4½% Bonds of 1933	4½%	4½%	97—99	...	...	98¼	Apr. 30	4 12 0	Jan., July	102	73
1,192,707£	...	Do. 6% 1st Income Debs.	6%	6%	109—111	...	— ½	110	Apr. 30	5 8 3	Mar., Sept.	117¼	109
6,120,750£	...	Do. 6% Income Bonds	40/-	60/-	91½—92½	...	— 1	92¼	Apr. 30	5 8 3	Mar., Sept.	97½	18

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CONTRACTS AND ORDERS.

Messrs. Greenwood and Batley have obtained a contract from Huddersfield Council for a turbo-dynamo.

Belfast Council have accepted the tender of Babcock and Wilcox, Limited, for the supply of a water-tube boiler, at £2,805.

The United Electric Car Company, Limited, have obtained a contract to supply top covers to tramcars at Doncaster.

E. Green and Son have received a contract to supply a fuel economiser to Huddersfield Council electricity works, at £866.

The Val de Travers Asphalte Paving Company, Limited, have been successful in obtaining the War Office new contract.

Ganz and Company, of Budapest, were the successful tenderers for the construction of an electric tramway at Kolozsvar, Hungary.

R. White and Sons have obtained a contract to construct an aerial ropeway at Neepsend power-station of the Sheffield Corporation.

Salford Council have accepted the tender of the General Electric Company to supply three rotary converters and static transformers.

Alex. Stark and Sons have been awarded a contract for the construction of the Hawkhill tramway extension, at £7,871, by the Ayr Council.

Brush Electrical Engineering Company have secured a contract from Luton Council for two 1,000-kw. turbo-alternators and condensers, at £9,200.

Leeds Corporation have placed a contract with Willans and Robinson, Limited, for supplying a turbo-alternator, condensing plant, pipes, etc., at £20,399.

Chesterfield Council have allotted a contract to Hadfields, Limited, for five sets of manganese steel points, and to John Brown and Company for tyres at 30s. each.

Bury Council have accepted the offer of W. T. Glover and Company for the supply of cable, and that of the British Westinghouse Company for equipment for four tramcars.

The Equipment and Engineering Company have received a contract from East Ham Council for supplying six miles of figure 8 trolley wire, at 8¾d. per lb., exclusive of drums.

The Spencer Brake.—As a sequel to accidents caused on the Stalybridge and Hyde Joint Tramways, the Board have ordered that 14 additional cars be fitted with the Spencer mechanical slipper brake.

Walsall Council have allotted tenders as subjoined: Water-tube boiler, mechanical stoker, economiser, Babcock and Wilcox, Limited, £3,231; overhauling economiser, etc., E. Green and Son, Limited, £495.

Bell Punch and Printing Company, Limited, have been awarded a contract to supply tickets to the Yarmouth Corporation Tramways, in place of a tenderer who had declined to complete his offer.

Yarmouth Council have placed an order with Walter Scott, Limited, for the supply of 180 tons of steel tramway rails, at £8 2s. 6d. per ton, and with John Baker and Company for 60 steel tyres at 34s. 6d. each.

Glasgow Tramways Committee have accepted the appended tenders: Copper trolley wire, E. Le Bas and Company; copper strip, Leslie and Hall; D.C.C. wire, London Electric Wire Company and Smiths, Limited.

Walthamstow Council have referred back to the Tramways Committee the tender of the Brush Electrical Engineering Company, Limited, at £3,478, for four new tramcars. Objection was expressed to the amount of the tender.

Warrington Council have accepted the tender of the Brush Electrical Engineering Company for transformers, General Electric Company for direct-current motors, and the British Thomson-Houston Company for alternating-current motors.

Greenock Council have placed contracts as appended: Halley's Industrial Motors, Limited, motor wagon, £700; British Westinghouse Company, two alternating-current motors, 750 kw. each, to be coupled to existing low-tension dynamos, £2,288.

Babcock and Wilcox, Limited, have been allotted contracts to supply and erect a water-tube boiler, with superheater, chain-grate stoker, and pipework, at £1,920, to Battersea Council; and two steam units with chain-grate stokers to Woolwich Council.

Ilford Council have accepted the following tenders for tramway supplies: Lamp holders, batten holders, Para and Blackley tapes, General Electric Company, Limited; carbon brushes, Le Carbone; armature coils, British Westinghouse Company, Limited.

Haslingden Council have placed the following contracts: British Thomson-Houston Company, rotary converter; Ferranti, Limited, switchboard panel, etc.; Chloride Electrical Storage Company, extension of tramway switchboard; Siemens Brothers Dynamo Works, additional feeder cable.

New P-A-Y-E Cars for Leicester. The new prepayment cars of the Leicester Corporation Tramways, which were illustrated in our issues of March and April, were manufactured by the United Electric Car Company, Limited, the electrical equipments being supplied by Messrs. Dick, Kerr and Company.

Ilford Council have adopted tenders as subjoined for tramway supplies: General Electric Company, lamp holders, 3s. per dozen, batten holders, 3s. 9d. per dozen, Para tapes, 8s. per lb., Blackley tapes, 2s. 6d. per lb.; R. W. Blackwell and Company, P. and B. tapes, 11d. per lb.; Le Carbone (Limited), carbon brushes, 3¼d. each; British Westinghouse Company, armature coils, 2s. 5d. each.

Colchester Council have placed tramway department contracts with Stanford and Company, for castings and car fittings; Williams and Company, rubber and fibre; Dick, Kerr and Company, G. W. Allsop, and Jackson and Company, electrical equipment for cars; Fleming, Birkby, and Goodall, and Estler Bros., overhead equipment; Dick, Kerr and Company, and Malleable Steel Castings Company, car fittings.

Dublin Council have been recommended by the Electricity Committee to accept the following tenders: Babcock and Wilcox, Limited, boiler house plant, £11,024; British Reinforced Concrete Engineering Company, coal store, £5,929, and harbour piling work, £2,001; New Conveyor Company, conveying plant, £6,302; H. and J. Martin, building extension, £8,895; Worthington Pump Company, circulating water pipes, etc., £1,346.

Walter Scott, Limited, have received an order from Plymouth Tramways Committee for the supply of 100 tons of tramway rails at £8 10s. per ton. It was stated that two of four firms who were asked to tender had declined, being too busy, and that the others submitted prices which were subject to acceptance within seven days. The company have also received an order to supply 2,500 tons of steel girder tramway rails to Manchester Corporation.

Glasgow Council have accepted the following tenders: 40-ton overhead travelling crane for Port Dundas station, John Grieve and Company, £1,339; alterations in ash-conveying plant at St. Andrew's Cross station, Babcock and Wilcox, Limited, £1,595; feed pump for Port Dundas Station, J. and P. Hall, £272; coal conveyor for Partick works, Babcock and Wilcox, Limited, £390; motor for St. Andrew's Cross station, British Thomson-Houston Company, £218.

York Council have placed contracts as subjoined for plant required for extensions to the generating station: Two water-tube boilers, superheaters, chain-grate stokers, pipework, etc., Babcock and Wilcox, Limited, £4,213; supply and erection of 3,500-kw. turbo-alternator, condensing plant, etc., Maschinenfabrik Oerlikon, £9,967; storage battery and reversible booster, etc., and maintenance thereof for 15 years, Tudor Accumulator Company, £3,899, with a maintenance charge of £188 per annum.

Siemens Brothers' Dynamo Works have obtained contracts from Balfour, Beatty, and Company for the supply of "Tantalum" and "Wotan" traction lamps for the Luton, Llanelly, Dartford, Carlisle, Leamington and Warwick, and the Notts. and Derby tramway undertakings for one year, and from Wolverhampton Corporation for a similar period. They are also supplying carbon filament lamps and radiator lamps to Newport Corporation electricity and tramways department for the ensuing year.

Plymouth Council have authorised the tramways manager to arrange for the fixing of a radial truck to one of the cars as an experiment, at a cost of about £45. This course was adopted on the recommendation of the Tramways Committee, after considering a report presented by Councillor Stephens in relation to the annual conference of the Municipal Tramways Association and the exhibition held in connection therewith. The question of installing a set of chain-driven gearing was adjourned, in order that further information might be obtained.

Stalybridge and Hyde Joint Tramways Board have placed contracts as appended: Inspectors' mackintoshes, overcoats, etc., Huggins and Company, Limited, London; drivers' mackintoshes, C. Mackintosh and Company, Limited, Manchester; drivers' and guards' caps and covers, T. Simpson, Stalybridge; drivers' and guards' overcoats and guards' tunics and trousers, Briggs, Jones, and Gibson, Limited, Manchester; drivers' oilskin capes, H. Marchinski, London; buttons and numerals, W. Dowler and Sons, Limited, Birmingham. The tender of Mr. A. Williamson, of Ashton, was accepted for the supply of tramway tickets for three years.

Pearson, Huggins, and Company, Limited, have received a contract from Yarmouth Council for 90 tunics and trousers for motormen and conductors, at £1 7s. 9d. per suit; 90 caps at 2s. 6d. each; inspectors' tunics and trousers at £1 19s. 9d. per suit; caps at 6s. 9d. each. There were two local tenders. Councillor McCowan mentioned that the selected firm gave every satisfaction last year, and the material they tendered was very much the best. The committee, he added, endeavoured to make the best possible bargain, and were not restricted to the lowest tender. Messrs. Pearson, Huggins, and Company have also been awarded the contract for the supply of tunics, trousers, overcoats, and caps for the Walsall tramway employees during the ensuing two years.

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London County Council have accepted tenders as under: Johnson, Riddle and Company, printing and folding of the route map of the Council's tramways, about £1,370; W. and G. Cannon and Sons, heating apparatus for Poplar permanent way depot, £245; British Electric Transformer Company, static transformers for Shoreditch sub-station, £4,380; Hadfield's Steel Foundry Company, special work for additional cross-over at Southwark Bridge Road terminus; W. H. Lockett and Company, guillotine machine for the tramway printing works, £94 10s., less £10 for old machine; Morgan Crucible Company, foundry crucibles and furnace linings, £70 18s. 7d.; Bullers, Limited, 2,200 track insulators for electrical repairs and renewals of tramway lines, 3s. 7½d. each, and Doulton and Company, 3,200 porcelains required for the same purpose, 9d. each, total, £518 15s.; A. N. Coles, Plymouth, reconstruction on conduit system of horse tramways from Highbury Station to City Road, tramway works £45,772, improvement works £4,335, total £50,107; John Mowlem and Company, reconstruction of tramways on the conduit system from Chapel Street to Nile Street, Woolwich, and construction of authorised tramways on the conduit system from Catford to Southend, tramway works £40,614, improvement works £1,479, total £42,120; Newton Brothers, Derby, rewinding of seventeen 300 KW. and three 500 KW. motor generators at tramway sub-stations, £7,987.

Portsmouth Council have accepted the following tenders:

J. Shervell, pattern "B" brake shoes, £5 12s. 6d. per ton; Dick, Kerr and Company, steel axle collars, controller D.B.I. fingers, contact tips (D.E.I.), axle box spring washers; Dyer and Young, controller D.E.I. fingers; A. Webb, car bulkhead glasses; F. W. Rowlands and Company, car pinions, car gear wheels; the Equipment and Engineering Company, brake handle ratchets; the West Bromwich Spring Company, for the whole of the springs at a schedule of prices; Samuel Cook and Company, sand tubes; Imeson and Finch, contact tips (D.B.I.); Tramway Supplies Company, trolley wheel bushes; Kay and Company, trolley wheels (bushed and unbushed); United Spring Company, for the whole of the spring washers; Marsh Brothers and Company, armature binding wire; Brecknell, Munro, and Rogers, trolley cable connectors; Dick, Kerr and Company, armature coils; Micanite and Insulators Company, sheet fibre, mica paper, commutator rings; the Mica and Standard Insulation Company, mica cloth; Pryke and Palmer, tape adhesive, ½ in.; J. G. Ingram and Son, insulation sleeves; the Edison and Swan United Electric Light Company, and the British Thomson-Houston Company, incandescent lamps in equal portions; J. Thomson, two-way trolley cable connectors, and mica, 5 miles; Watlington and Company, tape okonite; the Electrical and General Stores, rubber, oiled cloth; Watlington and Company, single and double body pull-offs, straight line hangers, car shed hangers, small Brooklyns; A. Wiseman, Limited, right and left-hand frogs and "Y" frogs; Tramways Supplies, Limited, crossovers, Clevis insulators (2 in. and 2½ in.); Brecknell, Munro and Rogers, large Brooklyns and terminal clamps; Fleming, Birkby and Goodall, for the whole of the cars, Clevis insulators (3 in.), span insulators (00 and 000), insulating bolts, Globe insulators (2 in., 2½ in., and 3 in.); W. B. Brown and Company, for the whole of the span wire and guard wire (No. 8); British Insulated and Helsby Cables, Limited, for 2 in. mechanical ears and 7½ in. S.B. ditto; Dick, Kerr and Company, for from 1st to 9th controller power barrel segments.

The Mirrlees Watson Company, Limited, of Scotland Street, Glasgow, have recently received orders for the following steam condensing plant machinery:

Surface condensing plant with Mirrlees Leblanc rotary air pumps: Two sets for the County of London Electric Supply Company, *per* the British Thomson-Houston Company, Limited; two sets for auxiliary machinery for H.M.S. "Queen Elizabeth," *per* Peter Brotherhood, Limited; one set for Aberdeen Corporation, *per* G. Wuthrich; one set for Sheepbridge Coal and Iron Company, *per* the British Thomson-Houston Company, Limited; one set for Fleetwood Urban District Council, *per* Jas. Howden and Company, Limited. Surface condensing plant with Mirrlees Edwards' air pumps: One set for the Lancashire Electric Power Company; one set for New Zealand, *per* Hendry Brothers. Mirrlees multi-jet condensing plant: Two sets for the Summerlee Iron Company, and one set for the Cambrian Collieries, *per* the A.E.G. Electric Company; one set for Flemington Coal Company, and one set for Tinsley Park Colliery, *per* Greenwood and Batley, Limited; one set for Moorbrook Mills, *per* the British Thomson-Houston Company, Limited; one set for Bargoed Colliery, and one set for Glasgow Iron and Steel Company, *per* Fraser and Chalmers, Limited; one set for the Weardale Steel, Coal, and Coke Company (repeat order); two sets for the Londonderry Collieries, Limited, *per* Wm. C. Mountain; one set for the Powell Duffryn Steam Coal Company, Limited; one set for J. Whiteley and Sons, Limited, *per* Daniel Adamson and Company; one set for the Glengarnock Iron and Steel Company, *per* Jas. Howden and Company. Barometric condensing plant with Mirrlees Leblanc rotary air pumps: One set for Birtley Colliery, *per* C. A. Parsons and Company; one set for the Powell Duffryn Steam Coal Company. Mirrlees Leblanc simple jet: One set for the Denton Colliery Company, Limited. Low level jet plants: Two sets for the Sheepbridge Coal and Iron Company, and one set for Dinnington Main Colliery, *per* the British Thomson-Houston Company, Limited. Barometric plants with reciprocating dry air pumps: Four sets for Peru, and one set for the Argentine.

The above represents a total steam duty of over 1,000,000 lb. per hour.

Manchester Tramways Committee have placed the following contracts for stores, etc., required during the ensuing year:

Dyer and Young, assembled commutator segments; British Thomson-Houston Company, Limited, motor and controller spare parts, motor cases; L. Andrew and Company, fibre barriers and circuit-breaker handles, etc.; Dick, Kerr and Company, Limited, motor and controller spare parts, etc.; British Westinghouse Electric and Manufacturing Company, Limited, motor and controller spare parts, etc.; Estler Brothers, controller fingers, etc.; Kay and Company, Limited, motor brush holders; Manchester Armature Repair Company, armature and field coils; P. R. Jackson and Company, Limited, armature and field coils; Electro-Mechanical Brake Company, Limited, grid resistances; H. Walliwork and Company, Limited, grids for resistances; Brecknell, Munro, and Rodgers, Limited, trolley poles, etc.; General Electric Company, Limited, incandescent lamps, bells, lighting material, telephones, testing instruments, etc.; Commercial Electric Company, Limited, incandescent lamps, traction type; S. Gratrix, Junior, and Brother, Limited, bell presses, arc lamp globes, sundry glass, etc.; C. Macintosh and Company, Limited, cells, insulation tape, goloshes, rubber gloves and gauntlets, etc.; Eckstein, Heap, and Company, Limited, spare parts for Gilbert arc lamps; Meirowsky and Company, amber mica segments for commutator bars, etc.; Sutcliffe (Crumpsall), Limited, fibre sheets and stick fibre; Spicer Brothers, Limited, red fibre paper, leatheroid strips, insulation paper and cloth; British Xylonite Company, Limited, celluloid; Connolly Brothers, Limited, P. and B. tape, power and lighting cables; I.R., G.P., and T.W. Company, Limited, linen tape; Pinchin, Johnson, and Company, Limited, insulation varnish; R. W. Blackwell and Company, Limited, insulating compound; Morgan Crucible Company, Limited, carbon brushes, etc.; Baxendale and Company, Limited, arc lamp carbons, turpentine, etc.; Alfred Wiseman, Limited, overhead equipment insulating material, pole switches; General Patents Company, trolley heads; Fleming, Birkby, and Goodall, Limited, trolley wheel bushes and spindles; Souper and Callaghan, automatic sanding devices; John Taylor, tubular sand controllers; Hudson and Bowring, Limited, automatic life-guards; Philipson and Company, folding side-guards; T. Bolton and Sons, Limited, copper wire, copper strip and sheet copper; C. Clifford and Sons, Limited, brass wire; F. Smith and Company, Limited, steel wire; Richard Johnson and Nephew, Limited, galvanised steel wire cable and rope; I. Bentley and Company, Limited, lubricating oils, etc.; J. Stoddart and Son, paraffin oil; British Petroleum Company, Limited, motor spirit; Hardman and Holden, Limited, creosote oil; Newton, Chambers, and Company, Limited, disinfecting fluid and powder; Reliance Manufacturing Company, liquid metal polish; Till and Whitehead, Limited, sundry workshop tools, plant and appliances, etc; Carborundum Company, Limited, special blocks for grinding steel rails; London Emery Works Company, Limited, specials for grinding steel rails, etc.; West Bromwich Spring Company, Limited, truck springs, etc.; J. Billingham, brake chains; Brampton Brothers, Limited, gear chains for brakes; Milnes, Voss, and Company, Limited, car fenders; Cammell, Laird, and Company, Limited, tramcar axles; J. Brown and Company, Limited, tramcar wheel tyres; F. W. Rowlands and Company, gear and pinion wheels; National Rail and Tramway Appliances Company, Limited, iron castings, brake block castings; Interchangeable Brake Block Company, Limited, chilled brake block castings; Moston Malleable Castings Company, malleable iron castings; Leys Malleable Castings Company, Limited, gear-case castings; S. Pearce and Sons, Limited, steel castings; Armstrong Oiler Company, Limited, lubricant pads for axle boxes; J. Carr and Sons, Limited, trolley cord; Chamberlain and Hookham, Limited, ampere-hour tramcar meters; British Oxygen Company, Limited, oxygen gas and acetylene gas; Thermit, Limited, Thermit welding material.

PERSONAL.

Mr. F. W. Purse, electrical engineer to Watford Urban Council, has been appointed to a similar post at Carlisle at a salary of £500 a year.

Mr. R. B. Leach has been appointed borough electrical engineer to Heywood Council, at a salary of £200 per annum, out of 134 applicants.

Mr. C. E. C. Shawfield, on retiring from the post of borough electrical engineer at Wolverhampton, has been presented with a silver salver by the employees.

Mr. H. Gray, electrical engineer to Accrington Council, has been voted an honorarium of £50 for his services in connection with the extensions at the electricity works.

Messrs. F. Bland and P. Brown have been appointed members of the Engineering Standards Committee for rails, with a view to standardising points and crossings.

Mr. H. Pilling, tramways manager and engineer to Accrington Council, has been granted an increase in salary from £200 to £225, with a further increment of £25 next year.

Mr. H. Richardson, engineer and manager of Dundee Corporation electricity department, has been entertained at dinner by the staff in recognition of his tenth anniversary in those capacities.

Councillor J. A. Wilson, of Bournemouth, has been entertained at dinner and presented with a suit case by a local organisation in recognition of his services towards securing the Sunday tramcar service.

Mr. Henry King, traffic superintendent to the Merthyr Tramways Company, has been appointed by the Aberdare District Council to a similar position in connection with the Council's new tramway scheme.

Sir Edward White has been elected chairman, and Mr. G. H. Hume vice-chairman, for the ensuing year of the Highways Committee of London County Council. This is Sir Edward's second period of service as chairman.

Mr. Harry Pool, accountant to the Leicester Corporation Tramways, was the recipient of a handsome clock from the staff of the tramways department on the occasion of his marriage, April 22, 1913. The presentation was made by Mr. A. F. Lucas, the manager.

Mr. G. I. Oxtoby, a member of the military band of York Corporation Tramways, has been presented with a silver cigarette case, subscribed for by the members of the social and athletic club in recognition of the services he has rendered. Mr. W. Clipper, traffic superintendent, made the presentation.

Mr. Robert Hamond, honorary treasurer of the Institution of Electrical Engineers, has been appointed by the Board of Trade to act as referee to settle the price to be paid by the Salford Corporation for electrical energy supplied by the Eccles Corporation in respect of a portion of their tramways.

Inspector R. H. Little has been presented with a gold watch and chain by the Lanarkshire Tramways Company's employees on the occasion of leaving to proceed to Australia. Mr. J. L. White, traffic manager, in making the presentation, referred to Mr. Little's good qualities, and wished him success.

Mr. J. Walters has been offered the position of assistant to the car shed superintendent of Newtown tramways, New Zealand, by the Tramways Board, at a salary of £220 per annum. Mr. Walters will pay a visit to England before taking up his duties, and the Board propose to contribute the sum of £25 towards his travelling expenses.

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Mr. Charles N. Hefford has been promoted to the managership of the electricity department of Leeds, in succession to Mr. H. Dickinson, who took up a similar appointment recently in Liverpool. Mr. Hefford, whose salary will be £600, was assistant to Mr. Dickinson. He will be succeeded by Mr. W. T. Green, who has been an assistant in the same department, and whose salary will be £400.

Mr. J. W. Cockrill, borough surveyor of Great Yarmouth, who has done a great deal of tramway construction for the Town Council, has been congratulated upon having been nominated President of the Institution of Municipal and County Engineers. The Mayor stated that when the Institution held their annual meeting in July the Corporation would not only make the visit of Mr. Cockrill's professional friends a pleasant one, but would also show them that he was honoured in the town.

Mr. S. T. Allen, electrical engineer to Carlisle Council, who has been appointed to a similar position at Wolverhampton, was highly spoken of during a discussion on the Electric Lighting Committee's proposal to fix the salary of a successor at £500, the official to be debarred from private practice and from taking pupils. It was stated that he had brought the undertaking from a non-paying to a paying condition, and that his salary of £600 had only being a commencing one. The recommendation was adopted.

Mr. H. D. Douglas, car shed foreman to the East London Corporation Tramways, on leaving the department has been presented with gifts from the white and native employees. Mr. J. M. Lambe, town electrical engineer, in making the presentations, spoke of the work which Mr. Douglas had done, especially on the laying of the track, and the relaying of the old one. He also stated that Mr. Douglas had the honour to be the first in South Africa to built a tramcar, and as a practical man in shed and outdoor work he would be hard to replace.

Southport Tramways' Managership.—The Council in April decided to separate the electricity and tramways departments, and to advertise for a general manager for the tramways at a salary of £200 per annum. An amendment to appoint as manager Mr. T. J. Kendrew, the present deputy electrical engineer and tramway manager, was lost by 22 votes to 19. Several members who opposed the amendment said Mr. Kendrew would be at liberty to send in an application, and that the committee thought it would be best to invite applications in order that they might "see the class of man they could get."

Lowestoft Appointments.—In consequence of the resignation of Mr. Bruce, the electrical engineer, the Council have made the following appointments in the tramways and electricity departments: Mr. W. R. May (the present assistant engineer) to be borough electrical and mechanical engineer at a commencing salary of £250 per annum, increasing to £280 by annual increments of £10; Mr. H. H. Saunders to be general manager of the electric light and tramways at a salary of £250 per annum, increasing by £10 per annum to £280. Mr. Saunders was formerly chief clerk in the tramways department.

Mr. Dacre Helme, tramways manager and electrical engineer to Nelson Corporation, died on April 18 after a short illness from pneumonia. Mr. Helme, who was 39 years of age, leaves a widow and one child. The funeral on April 22 was attended by the Mayor and Corporation and the borough officials. Mr. Helme was appointed in 1906, after two years' service as chief assistant engineer and a similar period as a mechanical fitter and electrical engineer. As the result of his management, the departments a year ago recovered from their unsatisfactory financial condition and registered a profit.

Mr. C. W. Mallins, general manager of the Liverpool Corporation tramways, on April 30 was granted an increase in his salary from £1,000 to £1,250. An amendment by the Labour party opposing the increase "because of the reduced travelling facilities and the way some of the employees had been treated," was defeated. Alderman Smith, chairman of the committee, stated that Mr. Mallins, by cutting down useless mileage, and by the introduction of several devices, had minimised the danger of accidents, and had improved the profits. He was a most earnest, deserving servant, a man with unrivalled knowledge gained during 40 years' service in Liverpool of horse tramway and electric traction. Alderman Salvidge added that since Mr. Bellamy's death the chief responsibility had fallen upon the shoulders of Mr. Mallins. For six or seven years Mr. Mallins had been carrying out the duties for which Mr. Bellamy received £1,500.

Mr. Z. E. Knapp, who for three years has been general manager of the London United Tramways Company, on his transference to the Underground Electric Railways of London as chief engineer, has been presented with a gold watch suitably inscribed. Mrs. Knapp received a gold chain purse. The ceremony took place at a great gathering of the staff and employees at Chiswick Town Hall, the presentation being made by Mr. J. B. McKinnon, traffic superintendent. Mr. A. H. Stanley, a director of the London United, and managing director of the Underground Railways, who presided, paid a warm tribute to Mr. Knapp for the interest he had manifested in the welfare of all grades of the employees, and in reply Mr. Knapp said he would not wish for more loyal service than he received from all grades on the system. The one change that gave him the greatest satisfaction was the introduction of the so-called "educational" system. The old method of disciplining men by suspension did not work well. Under the new method of merit and demerit marks a man was disciplined without the consequences reacting upon those who were dependent upon him.

Mr. Ernest H. Hiley, the divisional goods manager of the Northern Division of the North Eastern Railway Company, has been appointed general manager of the New Zealand Government Railways. Mr. Hiley, who is a son of the late Rev. Walter Hiley, Rector of St. John's, Stamford, Lincolnshire, and who was educated at Rossall School, entered the accountant's department of the North Eastern Railway, at Newcastle, in 1891. He was transferred to the office of the superintendent of the line at York in 1894, and, after filling various positions in the traffic department at York, was appointed assistant district superintendent at Newcastle, in February, 1902. He became district superintendent at York in April, 1904. In 1905 he was appointed chief passenger agent of the Great Northern Railway, King's Cross, and in 1908 he returned to the North Eastern Railway as district goods and docks manager at Hull. A year later he became divisional goods manager of the Southern Division, and he remained in charge of the Hull district and docks, and took supervision also of goods and mineral matters in the southern half, including the districts of York and Leeds. On November 1, 1911, he was appointed divisional goods manager (Northern Division).

Mr. W. Wyld, borough electrical engineer and tramways manager at Birkenhead, at the April meeting of the Council, was granted an increase in salary from £600 to £650. Councillor Halsall, in proposing the increase, pointed out that Mr. Wyld had not had an increase since 1908. Alderman Pearson said that two years ago Mr. Wyld took the responsibility of being electrical engineer as well as tramways manager, and he had succeeded very well. He was a hard-working and concientious official. On April 17 Mr. Wyld was appointed borough electrical engineer at Hampstead, at a salary of £700 a year, together with a bonus calculated on the net profits of the undertaking. There were 80 applicants. The appointment became vacant owing to Mr. Couzens having accepted a position in Canada at £2,000 a year. This is the second time that Birkenhead has provided the succesful occupant for a more important position. Mr. Wyld entered upon the Birkenhead appointment in 1904, filling the vacancy caused by the promotion of Mr. A. R. Fearnley to Sheffield. Mr. Wyld's career may be epitomised as appended: Educated at University College, Sheffield, studying mechanical and electrical engineering; articled to electrical engineering at Darlington; assistant in Blackpool electricity works; chief assistant at Salford; with the Patent Shaft and Axletree Company, Wednesbury, designing and fitting up the electrical power and light station; electrical engineer at Doncaster, superintending the construction of the tramways; appointed to Birkenhead, and subsequently undertaking the duties of both electrical engineer and manager of the tramways. Mr. Wyld is a member of the Liverpool Engineering Society, and last year served as a member of the Council of the Tramways and Light Railways Association.

Mr. T. J. Davison, building superintendent under the Tramways and Electricity Committee of the Belfast Council, died on April 8, after a brief illness. He had carried out the task of reconstructing the various horse car depots for the housing of electric cars without interruption of the horse car services, and he also erected the new depots at Shore Road and at Ardoyne. A local contemporary says: "We have the authority of Mr. Nance for stating that, in his and Mr. Blackburn's opinion, the depots of Belfast could be confidently shown by the Tramways Committee in competition with any others in the United Kingdom, with the certainty that they would be in the running for first prize."

OILSKINS FOR MOTORMEN.

The Ailsa Oilskin and Rubber Company, of Dalry, Ayrshire, offer to send a sample oilskin coat, in order to give tramway managers and others interested an opportunity of thoroughly testing these garments. The company has had much experience in the manufacture of oilskin coats, and those who have had trouble with garments of this kind will be interested in a letter from the manager of the Paisley District Tramways Company written to the makers, stating that after having given the firm an order for half of their supply for the past two years, they had found the coats to be so satisfactory that they decided to place the whole of the order with the Ailsa Company. The makers give careful attention to blending the oils used in their dressing, so as to ensure a thoroughly waterproof and durable garment, which will remain soft and pliable. The sleeves are three-ply, and are fitted with a seamless sheath of heavy material which entirely covers the fore-arm, where the friction is greatest. The scye, armpits, and back of the shoulders are well secured with padded chafing pieces, and there are inside elastic cuffs, leather bound, and strapped to secure buttons and button-holes. A useful feature of these coats is that they can be re-sleeved, or the sleeves re-sheathed, and the coats re-dressed again after being worn.

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TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.—An inexpensive shelter and a method of solving the caretaker problem for the same are subjects dealt with in the following report presented by Mr. R. S. Pilcher, the tramways manager: "The shelter authorised to be built at the Bridge of Don terminus has been finished, at a cost of £40. I believe this type will fill the requirements of a shelter such as we want. It gives sufficient protection from the wind and rain to intending passengers; it is not sufficiently warm to attract undesirable persons; and there is not anything that can be damaged. I think that shelters of this type should be built at the other car termini. Suitable sites can be found at St. Fittick's Road, Mannofield, and Rubislaw. With regard to the Bridge of Dee, a suitable erection is already in existence, and can be purchased for £40. The outside appearance of the building could be improved and half of the interior could be let to a suitable person, rent free, for the sale of sweets and refreshments—the tenant to act as caretaker of the shelter and keep it clean."

BRADFORD.—The rails, of light silicon steel, for the recently opened extension of the tramways to Bailiffe Bridge were manufactured at the Leeds Steel Works, and the track has been constructed on the Dawson and Foster patent reinforced system, which, it is claimed, reduces the cost of maintenance to a minimum.

DUBLIN.—Mr. J. W. Hill, deputy-chairman of the Dublin and Lucan Electric Railway Company, at the half-yearly meeting, stated that the coal account showed a saving of £80, despite the higher price paid for fuel. This, he said, showed that the mechanical stokers installed about a year ago warranted the expense incurred.

DUNDEE.—Dundee Tramways Committee have appointed a committee to fix the halfpenny stages at a uniform distance of 950 yards or thereabouts. Councillor Spence remarked that with the penny-all-the-way fare Dundee tramways had been singularly successful, and were the wonder and envy of the tramway world, a result which he attributed to the very patient, efficient, and firm attitude of their manager.

GLASGOW.—In connection with a complaint made at Glasgow that the body of a boy who had been run over by a tramcar had to remain under the car until the breakdown motor lorry arrived, it is stated that the tramways department had given an order for the supply of lifting jacks. Each car is to carry a jack capable of lifting the vehicle off the rails.—In return for the privilege of allowing policemen in uniform to travel free on the tramcars, the Tramways Committee have asked for a contribution of £250 per annum from the Watch Committee. The total cost of the privilege is from £800 to £1,000.—The stop by request signs are being removed from the corners of the streets to positions 20 yards from the corners. The idea is to prevent the mishaps sometimes caused by other vehicles turning rapidly from a cross thoroughfare when the car is standing just around the corner.

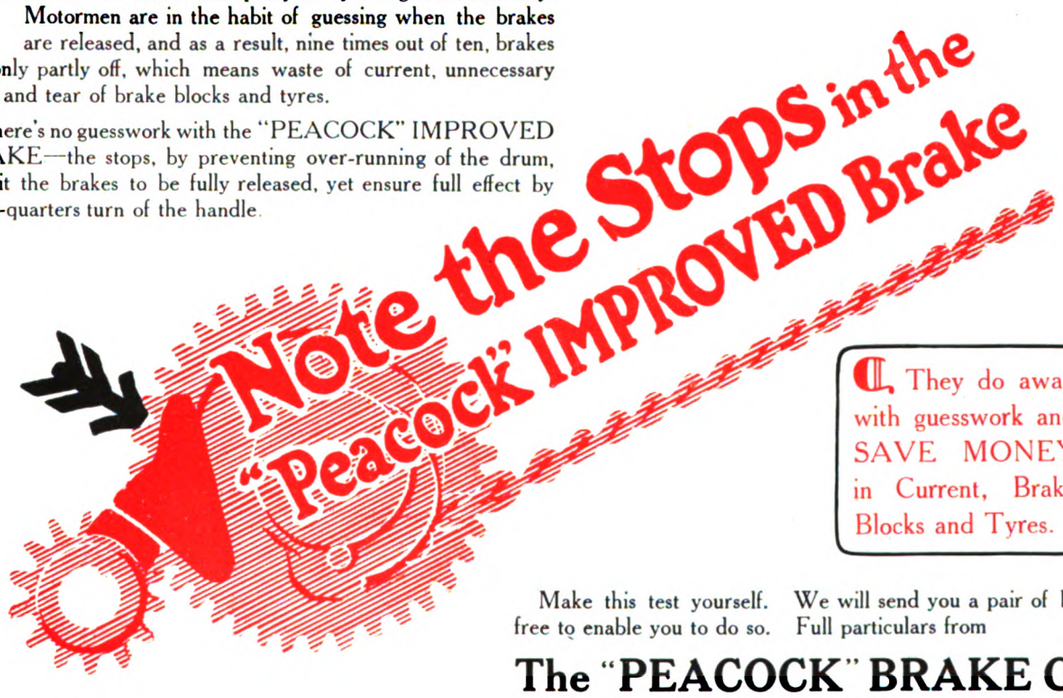
LEEDS.—As the result of a month's trial of collecting fares on the platform, Mr. Daggett, traffic manager, has stated that the conductors showed eagerness to collect these stray fares on the platform. The inspectors reported that there were far fewer mis-fares now than formerly, an improvement which the conductors were bound to appreciate. The public had taken very kindly to the new system. They realised that it meant no extra trouble for themselves, whilst, without doubt, it did away with a great deal of quite unnecessary fatigue for the conductors.—At Otley Police Court on April 4 the Leeds Corporation were summoned for the non-payment of a portion of rates with respect to that part of their tramway system which passes through Yeadon. Mr. R. S. Mandale, on behalf of the District Council, said the point involved was whether or not a tramway was a light railway. Up to a certain time the Corporation paid rates on the undertaking as a tramway, but later, after an appeal to the Courts, they only paid as a light railway. An appeal had been lodged by Tottenham Council in the higher courts, asking the Court to say that a tramway was not a light railway, and he therefore suggested that until this was decided the case might stand over. The Bench granted an adjournment for three months.

LEICESTER.—The Tramways and Electricity Committee have recommended the erection of car repairing shops at an estimated cost of £23,000. Their chairman stated that it was not intended at present to build cars, and after considerable debate the report was adopted.

LIVERPOOL.—A request was made by two members at a meeting of the City Council for copies of reports to the Tramways Committee on the condition of the cars to be sent to members of the Council. Alderman Smith, chairman of the committee, replied that the committee were endeavouring to get the noisy cars off the road as soon as possible. The reports were private reports for the information of the committee. Sir Charles Petrie said the committee seemed to be suffering from having too many amateur engineers. It was, of course necessary to scrap a number of cars. Many had been running for 15 years, and, as these had not been built for top covers, the trucks and motors had worn out much quicker than would otherwise have been the case. By 53 votes to 16 the Council declined to accede to the request.

HERE is a test which will open your eyes to greater economy. Motormen are in the habit of guessing when the brakes are released, and as a result, nine times out of ten, brakes are only partly off, which means waste of current, unnecessary wear and tear of brake blocks and tyres.

There's no guesswork with the "PEACOCK" IMPROVED BRAKE—the stops, by preventing over-running of the drum, permit the brakes to be fully released, yet ensure full effect by three-quarters turn of the handle.



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NEWCASTLE.—The tramways department are reconstructing over 30 cars, which are to be provided with covered tops and vestibule fronts. Good progress is being made with the extensions of the tramways to Benton and Newburn. The former will be opened early in May, and a portion of the latter in June.

SOUTH SHIELDS.—Alderman Wylie, chairman of the Tramways Committee, has reported to the Council that the traffic receipts for the 12 months ended March 31 showed an increase of £1,500 over the previous year, and that the tramways had just completed seven years of the undertaking, and during that time 51 million passengers had been carried, and there had never been a fatal accident. This, he thought, was unknown on any other tramway system. During the seven years the life-guards on the cars have picked up 40 persons, mostly children, without any serious injury. In every instance in which the guards have been brought into service they have acted satisfactorily.

TRAMWAYS CONGRESS AT BLACKPOOL.

The Tramways and Light Railways Association will hold their annual congress at Blackpool on June 12 and 13. Arrangements have been made for special saloon carriages to be run on the 2 p.m. train from Euston on Wednesday afternoon, June 11, for the convenience of members travelling from London and several stations *en route*. The Mayor and Corporation will entertain the members at a banquet on the evening of the 12th, and among other arrangements is included an excursion to Furness Abbey. By the courtesy of Mr. Laing, general manager of the Blackpool, St. Anne's, and Lytham tramways, members of the Association will have the opportunity of using the St. Anne's golf course. Full particulars may be obtained from the secretary of the Association, Mr. A. de Turckheim, Caxton House, London, S.W.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS.

Applications for Letters Patent have been filed:

7,508 Life-saving guard for mechanically-propelled vehicles—A. W. Robinson and E. J. B. Norris.
7,535 Car journal boxes—A. Berry.
7,556 Air brakes—C. E. Rochambeau.
7,623 Turbine plants—W. Croft.
7,625 Automatic brake slack adjusters for railway carriages, etc.—Birmingham Railway Carriage and Wagon Company, Limited, and E. O. Hill
7,637 Hanger straps for interiors of tramcars, motor 'buses, etc.—J. Whitehead, Senr., and H. J. Whitehead, Junr.
7,697 Elastic fluid turbines—Warwick Machinery (1908), Limited *(General Electric Company)*.
7,773 Automatic brake-operating devices—G. Gröpler.
7,805 Electrical conductors and supporting means for same—British Insulated and Helsby Cables, Limited, W. M. Mordey, J. W. Astley, and D. B. Saunderson.
7,870 Locomotives fitted with steam superheaters—J. G. Robinson.
8,052 Lubricator box for tramway and railroad vehicles—C. Delmez.
8,106 Railway cars—J. Lindall.
8,127 Concrete railroad cross tie—E. J. Rosencrans and H. Sanderson.
8,142 Fenders for vehicles—A. J. Kolanko.
8,147 Car replacers—A. L. Calhoun.
8,245 Apparatus for governing the speed of trains—A. E. Alexander.
8,249 Signalling systems and the control of trains—E. C. R. Marks *(E. G. Mascarenhas)*.
8,266 Joints for railway rails—M. Ledoux.
8,267 Electric collectors for tramway vehicles—A. Helfenstein.
8,273 Electrical indicating apparatus for use on steam trains—W. White and G. H. Gardener.
8,340 Rail joints for railway tracks—B. Keller.
8,454 Railway locomotive—T. H. Brigg.
8,458 Life-guard for motor vehicles—W. J. Ashley and E. Joblin.
8,513 Apparatus relating to emergency brakes for motor omnibuses—H. Werner and G. Sparks.
8,547 Electric control for track switches of tramways—R. Cumming.
8,624 Automatic systems of train control by means of separately-actuated contactors—Siemens Brothers' Dynamo Works, Limited, and A. M. Duke.
8,647 Street or road railway points—J. Duggan and H. F. Solaini.
8,675 High-potential electrical insulators—British Thomson-Houston Company, Limited *(General Electric Company)*.
8,685 Railway signalling apparatus—W. B. Fellows and J. H. Fellows.
8,717 Lubricators—G. Scholten.
8,720 Railway safety device—S. G. Davis and M. H. Doty.
8,725 Tie plates for railroads—J. Lundie.
8,727 Hand brakes for tramway cars—A. Elorza.
8,728 Apparatus for operating points—H. A. Thomson.
8,746 Electro-pneumatic signalling systems—E. C. Irving and British Pneumatic Railway Company, Limited.
8,823 Electrical track circuits for signalling—J. Sayers and F. B. Holt.
8,865 Electric controlling valve for air brakes—H. Gallusser.
8,879 Passenger registers for tramcars—E. Priestman and F. Nell.
8,922 Seats for tramcars—E. S. Rayner.
8,946 Car roofs—G. Frentzen.
8,985 Metal conduits for electrical conductors—R. N. Cunningham.
9,006 Railway safe-running devices—A. R. Angus.
9,007 Rail grinding machines—G. E. H. Woods.
9,030 Rail fastener for metal ties—F. J. Schisler.
9,066 Braking contrivances for tramcars—F. van den Straeten.
9,090 and 9,103 Railway safe-running devices—A. R. Angus.

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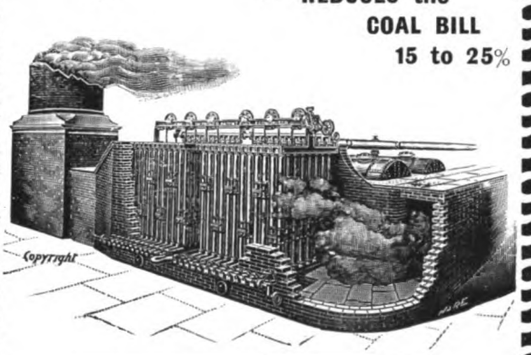

Patentees and Sole Makers—

E. GREEN & SON, LD., Wakefield, Manchester, London, and Glasgow.

9,110 Net life-guard for motor omnibuses—E. Abbott.
9,150 Audible signalling devices for railway permanent way—F. Page.
9,258 Life-guards for motor omnibnses—H. V. N. Graveley.
9,259 Rail joints—F. B. Marriott.
9,274 Brakes for electric vehicles—F. C. V. di Castelletto.
9,291 Point-setting apparatus operated by train—E. von Böhlke.
9,474 Track fasteners—O. Imray (*National Malleable Castings Company*).
9,475 Rail joints—O. Imray (*National Malleable Castings Company*).
9,477 Rail supports—O. Imray (*National Malleable Castings Company*).
9,547 Method of drawing up and securing the pendant ends of broken trolley wires—G. Lekkerkerker and P. J. Beckx.
9,565 Life-guards for motor road vehicles—W. Stevens.
9,632 Electrical signalling—J. C. Thomson.
9,652 Brake mechanism for vehicles—G. A. Albanese.
9,653 Automatic couplers for tramway cars—C. Watson and A. Ingrem.
9,744 Life-saving apparatus for motor vehicles—V. H. Whiteman.
9,778 Rail joints—P. Yordon.
9,852 Route indicators—T. Clarkson.

Specifications Published.

1912.

747 Snow remover and rail cleaner for tramways—Jones.
5,721 Means for operating track and conductor points on tramways—Tyrer and Whalley.
6,473 Insulating supports for conductor rails—Brook.
17,761 High-tension insulators for overhead lines—Fellenberg.
7,591 Protective devices for conductor rails—Merz and Redman.
19,160 Contact devices for controlling points or signals on electric tramways—Weenen, Stoffels, and Vander Sprenkel.
7,905 Elastic fluid turbines—Churchill Shann.
8,611 Electric motor control systems—British Tomson-Houston Company (*General Electric Company*).
7,938 Apparatus for operating the points of tramways—Thomson.
10,434 Automatic signalling arrangement for tramways—Samaia.
13,166 Point or switch-operating mechanism for railways—Lance.
15,022 Trolley heads—Parker and Smith.

1913.

486 Traffic-controlling apparatus—Holliday.

For **Directories of Electric Tramways and Railways,** *vide* pages xxv.—xxxiv. of this issue.

TRAFFIC RETURNS.

TRAMWAYS AND OMNIBUSES.

Name of Company or Corporation.	1912. Weeks Ending. Apl. 6.	Apl. 13.	Apl. 20.	Apl. 27.	1913. Weeks Ending. Apl. 5.	Apl. 12.	Apl. 13.	Apl. 26.	Aggregate. Wks.	1913.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	1,221	1,403	1,332	1,306	1,442	1,454	1,389	1,411	47	70,499	+ 2,164
Ayr Corporation	215	265	242	238	218	239	225	256	49	14,925	+ 470
Bath Electric	726	1,084	790	861	750	748	758	839	17	12,496	+ 239
Birmingham Corporation	10,311	11,212	9,933	10,199	11,248	11,106	11,576	11,747	4	42,975	+ 2,145
Blackburn Corporation	725	1,707	1,110	1,196	1,156	1,172	1,166	1,240	4	4,935	+ 133
Blackpool and Fleetwood	541	729	379	409	440	342	323	365	17	5,889	+ 330
Blackpool Corporation	518	1,807	588	454	726	554	548	625	3⅓	2,453	− 852
Bolton Corporation	2,857	2,426	2,455	2,506	2,550	2,662	2,626	2,658	4	10,121	− 125
Bournemouth Corporation	2,322	1,797	1,825	1,701	1,766	1,759	1,985	1,899	4⅓	7,957	− 201
Bradford Corporation	4,055	6,865	5,330	5,511	4,130	5,534	5,458	5,712	4	20,834	− 1,633
Brighton Corporation	1,057	1,016	947	935	853	818	878	921	4	3,341	− 614
Bristol	6,463	7,961	6,447	6,665	7,110	7,076	6,915	7,313	17	114,847	+ 10,954
British Elec. Trac. Co's. Undertakings											
Airdrie	290	314	275	277	342	350	332	349	17	5,188	+ 611
Barnsley	99	147	132	171	187	199	211	214	17	3,411	+ 829
Barrow	410	394	341	366	352	356	353	382	17	5,725	+ 348
Birmingham and Mid. Joint Com.:											
Birmingham and Midland	948	1,221	854	879	915	922	964	977	17	15,914	+ 1,012
Dudley-Stourbridge	780	1,179	785	825	815	843	859	894	17	14,209	+ 1,321
South Staffordshire	909	1,344	868	892	944	964	982	1,005	17	16,540	+ 1,692
Wolverhampton District	459	642	430	443	457	471	491	503	17	8,198	+ 721
Devonport	619	639	574	560	549	521	481	498	17	8,431	− 80
Gateshead	1,002	993	908	946	1,051	1,061	1,066	1,098	17	17,743	+ 1,547
Gravesend and Northfleet	212	258	185	193	208	214	215	221	17	3,478	+ 207
Greenock-Port Glasgow	778	823	893	789	868	923	797	871	17	12,691	+ 609
Jarrow	132	131	125	149	130	135	140	144	17	2,144	+ 106
Kidderminster	101	159	90	108	86	92	98	104	17	1,608	+ 37
Merthyr	152	184	149	160	210	192	202	212	17	3,459	+ 549
Metropolitan Electric	9,257	10,722	8,286	9,124	8,521	8,571	8,612	9,527	17	141,380	+ 1,702
Middleton	316	433	312	353	298	297	317	336	17	5,140	+ 267
Oldham-Ashton	666	797	589	647	560	574	602	607	17	9,717	+ 228
Peterborough	134	141	111	116	120	122	126	149	17	2,042	+ 131
Potteries	1,374	1,616	1,691	1,809	2,059	2,012	2,065	2,623	17	34,665	+ 6,025
Rotherham	70	215	213	123	102	188	111	151	17	1,453	+ 238
Sheerness	48	51	42	43	50	48	48	49	17	774	+ 67
South Metropolitan	926	1,176	840	953	749	713	722	921	17	12,231	− 514
Southport	270	370	286	310	279	259	269	289	17	4,250	+ 189
Swansea	1,018	1,152	964	1,115	1,166	1,133	1,187	1,310	17	19,345	+ 1,638
Taunton	38	47	40	39	47	43	44	48	17	728	+ 66
Tynemouth	187	251	198	214	190	168	181	206	17	2,870	+ 252
Weston-super-Mare	38	109	66	88	62	54	61	83	17	801	+ 187
Worcester	287	386	280	270	259	266	286	296	17	4,271	+ 122
Wrexham and District	119	135	124	154	109	144	121	124	17	1,861	+ 175
Yorks. (Woollen) District	922	1,265	1,007	1,098	1,048	1,111	1,100	1,160	17	18,393	+ 1,582

(*Continued on page 358.*)

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TRAFFIC RETURNS—Tramways and Omnibuses—*continued.*

NAME OF COMPANY OR CORPORATION.	1912. WEEKS ENDING. Apl. 6.	Apl. 13.	Apl. 20.	Apl. 27.	1913. WEEKS ENDING. Apl. 5.	Apl. 12.	Apl. 19.	Apl. 26.	AGGREGATE. Wks.	1913.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Burnley Corporation	1.768	1.455	1.463	1.459	1.586	1.635	1.568	1.670	4	6.459	+ 314
Burton-on-Trent Corporation	276	273	259	253	265	274	272	279	4	1.052	+ 31
Bury Corporation	1.527	1.385	1.364	1.277	1.095	1.270	1.307	1.291	4	4.964	− 590
Cardiff Corporation	1.701	2.135	2.020	1.657	1.919	2.498	2.535	2.592	4	9.545	+ 2.032
Chatham and District	833	1.131	812	850	860	788	799	888	16	13.519	+ 266
Chesterfield Corporation	(10 days)	279	173	191	(10 days)	316	241	242	3	799	+ 148
Colne and Trawden	314	269	268	275	238	246	249	267	17	4.081	+ 142
Cork Electric	454	515	491	498	470	495	477	469	16	7.313	− 104
Croydon Corporation	1.865	2.220	1.736	1.876	1.502	1.468	1.468	1.683	3	5.455	− 1.712
Darlington Corporation	205	214	193	197	219	215	299	246	4	911	+ 101
Derby Corporation	477	599	679	803	883	838	747	946	4	3.414	+ 856
Dover Corporation	213	247	208	209	164	196	201	216	4	779	− 129
Dublin and Lucan	153	166	127	120	138	134	132	131	17	2.027	+ 49
Dublin United	5.980	6.153	6.172	5.719	5.905	5.595	6.122	5.822	17	91.214	+ 601
Dundee City	1.147	1.239	1.157	1.118	1.235	1.290	1.137	1.270	49	59.575	+ 2.144
East Ham Corporation	1.066	1.148	1.022	1.071	1.113	1.134	1.119	1.173	4	4.239	+ 243
Exeter Corporation	214	361	293	309	177	301	297	311	4	1.086	− 91
Glasgow Corporation	18.804	18.440	19.151	19.213	20.004	20.155	20.191	21.525	47	904.692	+ 15.268
Glossop (Urban Elec. Supply Co.)	43	46	78	121	118	122	122	130	17	2.080	+ 396
Halifax Corporation	...	2.657	1.924	2.005	...	1.802	1.898	1.883	3	5.822	− 1.220
Hastings and District	702	1.361	825	857	882	782	806	957	17	13.562	+ 541
Huddersfield Corporation	1.625	2.257	1.861	1.857	1.957	1.905	2.045	2.084	4	7.566	− 34
Hull Corporation	2.916	2.977	2.756	2.715	3.007	3.030	3.020	3.025	4	11.409	+ 248
Ilford U.D. Council	473	588	480	504	431	432	444	450	4	1.650	− 396
Ilkeston Corporation	No service		65	95	109	113	121	126	4½	497	+ 336
Ipswich Corporation	459	494	380	394	386	372	378	413	4	1.450	− 168
Isle of Thanet	518	629	429	415	348	330	399	450	30	9.913	− 120
Kilmarnock Corporation	145	147	150	148	162	161	160	166	49½	8.041	+ 60
Lanarkshire	1.119	1.227	1.313	1.485	1.658	1.654	1.575	1.806	16	25.993	+ 3.663
Lancashire United	1.088	1.750	1.252	1.341	1.323	1.360	1.435	1.434	16	22.350	+ 2.190
Leeds City	6.980	8.066	7.127	7.650	7.557	7.511	7.869	8.159	4	29.400	+ 1.995
Leicester Corporation	1.821	2.386	2.291	2.437	2.595	2.595	2.716	2.763	17	44.604	+ 4.783
Leith Corporation	688	674	717	650	666	652	623	684	49½	33.037	+ 878
Liverpool Corporation	11.574	12.060	11.485	11.804	12.931	12.263	12.288	12.449	16½	201.843	+ 10.178
Llandudno and Colwyn Bay	183	350	209	199	200	194	209	214	21	3.717	+ 417
London County Council	43.090	46.431	41.685	43.838	40.748	41.543	40.400	42.670	3	136.551	− 7.618
London General Omnibus	48.979	50.926	51.803	54.065	57.576	55.109	59.596	65.970	17	945.031	+226.624
London United	6.671	8.189	5.963	6.548	5.573	5.422	5.611	6.264	17	90.510	− 3.635
Lowestoft Corporation	163	163	128	125	137	122	121	130	29	4.648	− 3
Maidstone Corporation	149	222	162	177	153	178	167	187	4	685	− 24
Manchester Corporation	16.949	16.882	16.414	16.758	16.727	16.627	16.991	17.538	4	64.040	+ 1.667
Nelson Corporation	216	193	198	215	170	183	185	235	4	773	− 95
Newcastle-on-Tyne Corporation	4.135	4.541	3.856	4.000	4.416	4.475	4.455	4.558	4	16.900	+ 693
Newport (Mon.) Corporation	581	664	616	651	751	717	738	705	4	2.787	+ 293
New St. Helens and District	669	919	652	691	675	708	714	749	43	31.732	+ 1.127
Northampton Corporation	331	611	496	504	270	508	515	554	3½	1.846	− 93
Nottingham Corporation	3.424	3.426	2.947	3.058	3.333	3.198	3.190	3.267	3½	10.943	− 305
Oldham Corporation	1.881	2.284	2.039	2.002	1.962	2.047	2.094	2.106	5	9.993	− 271
Portsmouth Corporation	2.248	2.392	1.964	2.023	2.029	1.834	1.846	2.008	4	7.129	− 1.317
Preston Corporation	711	855	742	785	795	787	850	810	4	3.242	+ 149
Provincial	1.910	2.144	1.693	1.676	1.781	1.639	1.610	1.694	30	48.817	+ 2.110
Reading Corporation	(10 days)	693	559	595	(10 days)	619	633	643	3½	2.153	+ 42
Rochdale Corporation	1.640	1.559	1.441	1.513	1.406	1.460	1.517	1.566	4	5.610	− 424
Rotherham Corporation	558	686	576	659	864	876	886	930	3½	2.891	+ 803
Salford Corporation	5.309	4.866	5.029	4.784	4.860	4.878	4.978	4.871	4	19.588	− 422
Sheffield Corporation	5.912	6 267	6.142	6.334	7.100	7.094	7.412	7.262	5	33.870	+ 4.726
Southampton Corporation	330	1.331	1.107	1.224	352	1.124	1.132	1.248	3	3.857	− 122
Southend-on-Sea Corporation	550	1.038	630	630	644	614	618	692	4	2.099	− 403
South Shields Corporation	510	565	538	581	624	611	629	650	3½	2.355	+ 295
Sunderland Corporation	1.078	1.142	1.118	1.153	1.072	1.274	1.318	1.276	4	4.941	+ 449
Swindon Corporation	121	140	119	138	154	139	148	160	3½	484	+ 33
Tramways (M.E.T.) Omnibus Co.	...	...	...	...	2.311	2.253	2.769	3.050	17	19.723	—
Tyneside Tramways and Tramroads	418	807	447	465	437	468	464	489	17	7.770	+ 374
Wallasey Corporation	1.033	1.212	1.052	1.087	1.046	1.050	1.079	1.116	3½	4.043	− 242
Walsall Corporation	531	651	520	543	584	573	602	603	17	10.027	+ 841
Walthamstow U.D. Council	800	894	697	764	680	646	682	731	4	2.746	− 170
Warrington Corporation	415	440	384	405	435	432	437	439	4	1.481	+ 76
West Ham Corporation	2.559	3.226	2.462	2.697	2.564	2.587	2.630	2.786	3½	9.072	− 361
Wigan Corporation	1.017	1.201	1.109	1.238	1.412	1.363	1.382	1.419	3½	4.693	+ 598
Wolverhampton Corporation	1.142	889	939	994	973	994	1.028	1.019	5	4.303	+ 75
Yorkshire (West Riding)	1.198	1.409	1.228	1.249	1.320	1.251	1.293	1.432	17	22.765	+ 2.370
FOREIGN TRAMWAYS.											
Anglo-Argentine	51.613	54.121	53.159	49.407	59.251	54.424	57.457	56.692	17	948.255	+ 71.850
Auckland (28 days)	...	17.472	...	...	...	20.216	...	...	41	199.311	+ 27.267
Bombay	3.258	...	...	...	3.316	...	...	...	14	42.673	+ 1.242
Brazilian Street (month) Mlrs.	45.793	...	...	...	46.496	...	...	...	35	357.662	+ 4.145
Brazilian Traction	80.073	83.129	...	77.114	94.214	94.350	93.861	92.247	17	1.537.205	—
Brisbane (month)	18.820	...	...	...	26.370	...	...	...	13	74.040	+ 31.486
British Columbia (month) $	491.782	...	...	...	571.163	...	...	...	39	4.283.459	+ 854.242
Buenos Aires Port and City (month)	...	...	...	...	...	...	...	...	—	—	—
Buenos Ayres Lacroze (month)	...	...	...	...	...	...	...	...	—	—	—
Calcutta Rs.	63.776	56.010	59.898	57.080	63.600	64.036	66.096	63.006	17	10.99.330	+ 42.367
Cape Town (month)	12.071	...	...	...	13.197	...	...	...	13	39.287	+ 2.744
Carthagena and Herrerias (month)	915	...	...	...	3.050	...	...	...	13	13.122	+ 6.524
East India (month)	1.717	...	...	...	1.760	...	...	...	35	14.762	+ 2.308
Kalgoorlie (month)	3.384	..	...	...	2.862	...	...	...	13	8.240	− 712
La Plata (month)	...	..	...	3.987	...	...	...	5.306	17	21.595	+ 4.286
Lima (month)	33.246	...	...	...	35.430	...	...	...	13	101.877	+ 4.900
Madras Rs.	(2 weeks)	25,848	(2 weeks)	25.611	(2 weeks)	26.766	(2 weeks)	27.549	17	2.12.720	+ 16.713
Melbourne (month)	66.000	...	...	...	67.000	...	...	...	3	196.500	+ 4.500
Mexico (month) $	554.745	...	...	...	606.411	...	...	...	13	1.497.407	−104.115
Montevideo (month)	28.034	..	...	...	30.087	...	...	...	26	199.762	+ 14.400
Para	4.392	4.053	3.915	3.731	4.337	3.935	4.170	3.936	21	86.895	+ 4.235
Perth (W.A.)	1.936	2.025	1.796	1.861	2.188	2.123	2.065	2.044	17	35.579	+ 3.746
Port Elizabeth (month)	4.379	...	...	...	3.943	...	...	...	13	12.031	+ 375
Shanghai $	17.439	19.510	20.706	19.875	19.800	21.200	22.000	20.600	16	321.400	+ 24.767
Singapore $	11.428	10.746	10.072	9.586	11.675	11.804	11.432	11.223	17	193.885	+ 16.306
Toronto (month) $	668.194	..	...	...	772.491	...	...	...	13	2.267.732	+303.182
Winnipeg (month) $	298.838	...	...	...	329.016	...	...	...	13	1.000.945	+ 83.426
ELECTRIC RAILWAYS.											
Central London	3.600	3.822	4.214	4.313	5.295	5.370	5.322	5.034	17	90.369	+ 9.684
City and South London	2.658	2.984	2.936	2.976	2.925	2.916	3.131	2.850	17	51.041	− 3.918
Great Northern and City	1.420	1.529	1.567	1.562	1.431	1.433	1.454	1.408	17	25.386	− 3.278
Liverpool Overhead	1.445	1.572	1.614	1.538	1.537	1.560	1.631	1.628	17	26.854	+ 1.545
London Electric	12.355	13.620	13.190	13.365	14.175	14.495	14.975	14.435	17	247.505	+ 3.670
Mersey	2.174	2.119	2.054	1.961	2.457	2.250	2.236	2.173	17	38.355	+ 2.542
Metropolitan	14.655	15.515	15.987	16.634	15.698	15.867	16.600	16.823	17	277.122	+ 3.665
Metropolitan District	11.561	12.127	12.158	12.494	13.324	13.288	13.594	12.615	17	224.154	+ 10.903

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:: :: **E.C.C.** :: ::

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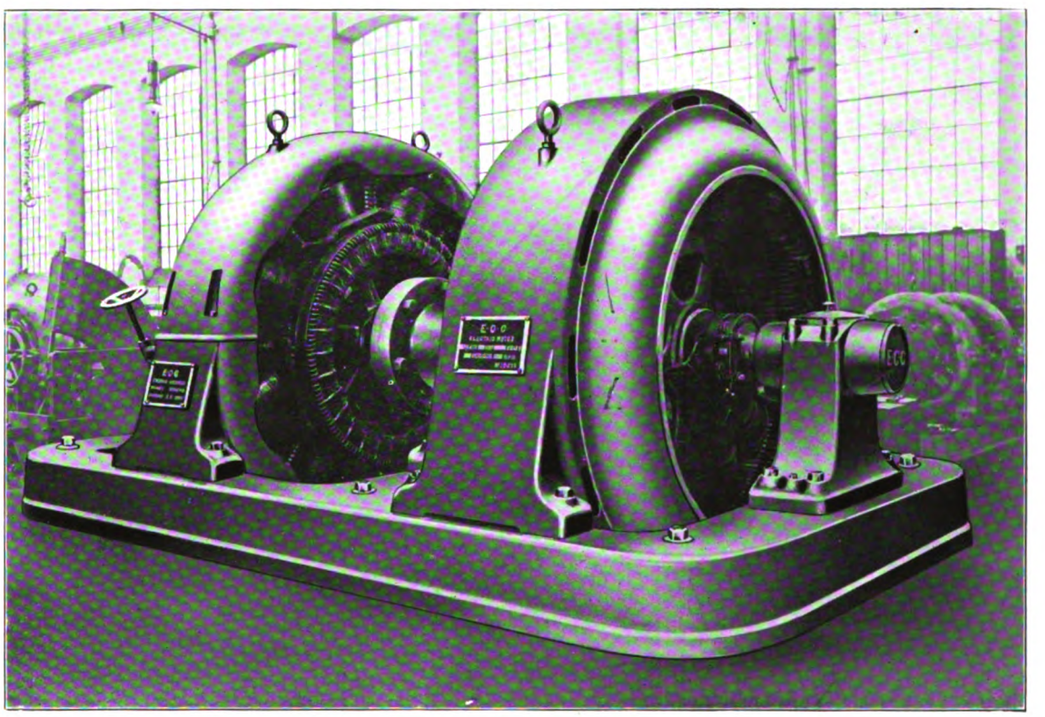
AND
SWITCHGEAR

OF EVERY DESCRIPTION.



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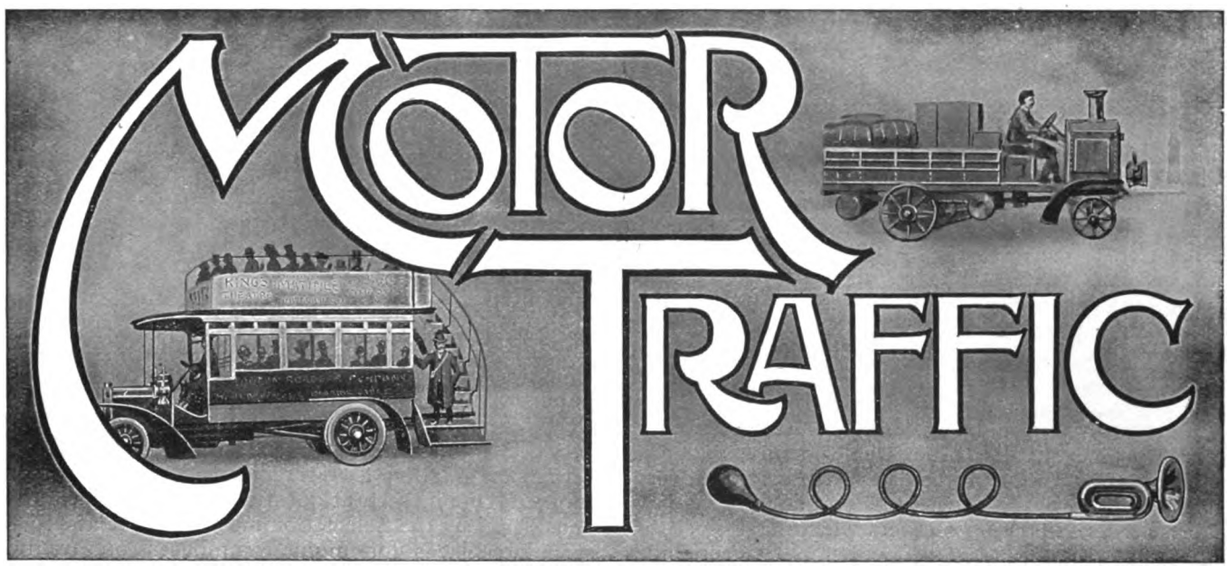

Steps are being taken for the laying of the foundation of a movement which is certain to result in a large and growing use of electric road vehicles in this country, greatly to the advantage of municipal and company power-stations. Such progress as has been made, and suggestions for the furtherance of the scheme, will be outlined in a paper prepared by Messrs. Seabrook, Mitchell, and Watson, for presentation at the forthcoming convention of the Incorporated Municipal Electrical Association. Ultimately it is hoped to form an electric vehicle association, on the lines of those in the United States. Apart from use as tower wagons the battery vehicle has an importance to municipalities in other respects as soon as sufficient become available for the purpose of experiments. The surveyor's department of a municipality also offers an extensive field of use. Therefore, from the point of view of local government authorities, it would not be inappropriate if the scope of the Municipal Tramways Association were widened so as to include the new vehicle. Not the least interesting would be its use for extending facilities for passenger transit, for if one may judge by the reports which are published from time to time in America, the present vehicle is far removed from the battery omnibuses which ran for a short period in London six years ago. Considering the length of time during which the English representatives of the Edison people have been at work in this country some disappointment may be expressed at the slow progress so far achieved. Their great difficulty appears to be their inability to obtain the batteries from the manufactory in America. The demand there is so great that the makers cannot keep pace with home orders, and so far they have paid little attention to the European market. Undoubtedly a factory must be established in this country before long, and then we may see progress that will perhaps surprise those who have not closely followed events in the United States. Some idea of what is being done there with accumulators may be gathered from the details given on another page of this issue of the notable performance of a rail-motor car, equipped with Edison batteries, which ran from New York to Boston, a distance of 306 miles, at an average speed of 27 miles per hour. Apparently the organisers on this side of the Atlantic have been a little too ambitious. According to an announcement made by one of their number the whole of Europe, with the exception of Germany and Austria, has been engaging their attention prior to launching the company which is being formed to develop the Edison vehicle. It is only lately, it would appear, that the promoters have taken in hand the work which confronts them in this country. Central station engineers and managers are asked to co-operate with a view to commercial cars being placed on the road for demonstration purposes. Those officials are invited to obtain "names of firms who will be willing to inspect and try the vans, and at the same time take careful note of the low running costs, the ease of maintenance, etc." Information is also required concerning the charging stations in each area, the current available at 110-120 volts, and from 30 amperes upwards. Considerable assistance in this direction has already been accorded by a number of engineers responsible for the management of power-stations, and the engineer and manager of the Ipswich electric supply and tramways departments has made some suggestions that are worthy of notice. Either the Tramways Committee should acquire an electric tower wagon, or some other department an electrically-propelled vehicle, he suggests, as a means of recommending the new method of traction to local traders. As to charging facilities he expresses the opinion that there will be an opening for manufacturers of electric apparatus to market a compact charging booster or motor generator which will have combined with it the necessary switches and instruments.

In the interest of the motor omnibus industry, and of local authorities who contemplate using road motor vehicles, immediate action should be taken to raise a protest in the House of Commons in respect to the manner in which a Committee presided over by Sir Ivor Herbert has handicapped both municipal and private enterprise. It is true that the Chesterfield Corporation's application is for power to run railless trolley cars as well as motor omnibuses, and that the local authority in order to increase the chances of their bill offered to adopt what has become known as the Keighley clause for widening, from the circumstance that the Keighley Council had the road widening liability placed upon them as the result of County Council opposition to their railless trolley car scheme. In the Chesterfield bill the county authority were also the chief objectors so far as concerns the portion of the routes which will be outside of the borough boundaries. The Midland Railway Company also opposed, although it is partly to remedy an inefficient railway service that the Council's scheme has been formulated. Responsibility to give a 17 ft. roadway and a 4 ft. footpath, however, does not constitute the whole of the liability

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MOTOR TRAFFIC.

which has been placed upon the local authority. While declining to impose compensation to the County Council in the form of mileage or otherwise for the use of the road, the Committee have required a clause to be inserted in order to render the Council "liable for damage arising out of the extraordinary traffic proposed by the bill, such damage to be assessed at the end of three years by arbitration." The Committee did not consider it would be just to indemnify the County Council for ever, in view of the strong expressions of opinion that there should be general legislation. A wiser course would have been for the Committee to have passed the bill and left the widening and road maintenance questions to be dealt with by the Government. As the result of their precipitancy they have placed burdens upon Chesterfield which have not been imposed in other cases, and it will not be surprising if as a sequel local authorities are discouraged from entering upon either railless trolley or motor omnibus projects.

A second blunder of the Committee is that they have placed the burdens upon both the trolley vehicles and the omnibuses, although the latter are already taxed by the petrol duty. Moreover, the Road Board can be applied to by the County Council for a grant towards any increased cost of road maintenance entailed by motor traffic. While the decision in the Chesterfield case may in some instances encourage private companies to come forward with schemes that will not need Parliamentary sanction, such companies will first have to obtain licences from the local authorities. The Committee's decision is the more to be regretted because it may debar promoters from using the motor omnibus in association with trolley cars, the purpose of the former being to test routes and to work up traffic. This method received the sanction of two tramway managers, Messrs. C. J. Spencer and A. R. Fearnley, the first named being responsible at Bradford for one of the oldest railless services in this country, while the Sheffield manager's evidence dealt more especially with the success which is attending his Tramway Committee's policy of providing motor omnibuses for routes not served by tramways. Manchester is the latest Corporation to come into line with more than half a dozen of the leading municipalities who have taken up the modern motor omnibus to work in undeveloped districts. Mr. J. B. Hamilton, the Leeds manager, was able, as the consulting engineer, to testify of the increasing number of such bodies, when giving expert evidence before Mr. Middlebrook's Committee, who passed the Southport Council's railless proposal, but rejected their modest scheme to run two motor omnibuses which are urgently required as feeders to the tramways. It is to be regretted that the opposition of local chars-a-banc owners complicated the position.

Sitting only twice a week for a period of four and a half hours, the House of Commons Committee of inquiry into the causes of accidents from power-propelled vehicles in London are taking a long time over their investigation. No criticism is likely to be levelled against them for the length of the proceedings if in their report they succeed in putting forward suggestions that give promise of reducing the number of accidents. Whatever proposals may be formulated for that purpose ought to be promptly considered by the three Government departments concerned with the several forms of traffic, with a view to drafting legislation. It is to be regretted that those departments will not have the assistance of the additional experts whose aid would have been available if the Traffic Board recommended by the Royal Commission had been appointed by the Government. If this Board had been in existence the probability is that the need for the investigation by the Committee of the House of Commons would not have arisen. If the Government pursue the same inactivity in regard to the report of the Committee as they have shown to that of the Royal Commission, their responsibility will indeed be serious in relation to future loss of life and personal injury. One important question which will have to be considered by the Select Committee will relate to the stopping places for motor omnibuses on tramway routes. The present lack of regulation is responsible not only for loss of life and serious accidents, but for traffic obstruction. Considerable difficulty is met with when one comes to consider the best solution of the problem. The trouble originated before the motor omnibus competition had reached a tithe of its present extent, and was due to the prosecution of a motorist in a provincial town for passing a tramcar on the side other than that authorised. After the case had been through the High Court the Motor Car Act regulation was amended to allow motorists to choose the side which gives promise of least danger.

So far the witnesses who have dealt with the stopping places of omnibuses before the Select Committee are the Commissioner of the Police and the managers of the London County Council and West Ham Corporation Tramways and the London and Suburban Traction Company. With the exception of Mr. Fell and Mr. Devonshire, these witnesses seem to agree that omnibuses should stop at such a distance at the rear of a tramcar that passengers may get on and off without any risk of being run down. The County Council's chief tramway officer's suggestion is that the omnibuses should go beyond the cars before stopping. Mr. Devonshire, who is now the manager of the amalgamated Metropolitan and London United Companies, suggests that there should be separate stopping places for omnibuses not less than 30 ft. ahead of the tramcars. He also advocates a limitation of the number of omnibuses, and, like Mr. Fell, he urges the provision of more refuges. At present there are drivers who adopt either one or the other of the two methods. At first sight Sir Edward Henry's idea would seem to be the one attended with less risk to persons desirous of entering or leaving a tramcar, but the fact has to be considered that the omnibus drivers under the present competitive regime strive to be first at the compulsory tramway stops. It would therefore be safest for all concerned if the omnibuses stopped well to the front of the tramcar, as this position would enable them to start again without being delayed by the movements of the tramcar passengers, for it is rarely that a lull in the oncoming traffic enables the omnibuses to pass stationary cars on the off side. So far no attempt has been made to carry into effect the suggestion made by the chairman of the Select Committee, to the effect that omnibus and tramway authorities should co-operate in giving a trial to the plan suggested by the Commissioner of Police.

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TRIAL OF AN EDISON STORAGE BATTERY VAN.

Under the Open Competition Rules of the Royal Automobile Club an Edison storage battery van, carrying capacity 1,000 lb., entered by Mr. F. J. Monnot, of 41, Great Portland Street, London, W., underwent a six days' test recently. The weight of the van, which was fitted with a canvas-top delivery body, was as follows: Complete van: front axle, 1,659 lb.; back axle, 1,593 lb.; total weight, 3,252 lb. (29 cwt. approximate); chassis (including battery): front axle, 1,206 lb.; back axle, 1,477 lb.; total chassis weight, 2,683 lb. (24 cwt. approximate). The battery consisted of 60 cells, coupled in series, each cell measuring 13¾ in. by 5¼ in. by 2½ in. An ampere-hour meter was fitted in view of the driver, in order to indicate the amount of current consumed. The routes comprised central and outer London thoroughfares and such rural roads as are comprised in the main road to Romford. The loads varied each day from 1,235 lb. to 458 lb. The average speed (running time only) varied from 8·89 to 12·39 miles per hour. The condition of the roads varied, being heavy on three days and fair or good on the other days. During the trial the total distance run was 312·3 miles, including the distance run between the lock-up and the charging station. A total of 191·81 units was used for charging the battery, the total time taken for the charging being 24 hours 30 minutes. The level of the electrolyte in some of the cells was tested on two occasions, and distilled water was added to all the cells three times, the total time taken for the latter being 37 minutes 17 seconds. A washer was fitted beneath one of the cell terminals which was not properly gripping the wire. The motor was examined on one occasion, 52 seconds being taken. After 75·5 miles had been run the following work was done: The ball, to which was attached the end of the steering arm, was found to be loose, and was tightened in 7 minutes 10 seconds; the corresponding ball socket was adjusted in 6 minutes 55 seconds; the step stays were tightened in 2 minutes 45 seconds; and the bearing of the off-front wheel was adjusted in 5 minutes 5 seconds. During the trial the van was oiled and greased in the usual way. On days Nos. 1, 2, 3, and 4 the maximum distance possible had been run upon the battery charge.

LONDON MOTOR VAN PARADE.

The Whit-Monday motor van parade on May 12 is under the patronage of His Majesty the King. The funds for this the seventh annual parade are supported by the Royal Automobile Club, the Society of Motor Manufacturers and Traders, and numerous well-known members of the motor industry. Donations of 20 guineas each have been made by the Anglo-American Oil Company, Limited; Messrs. Carless, Capel, and Leonard, the Continental Tyre and Rubber Company, the Dunlop Rubber Company, Fodens Limited, the Peter Union Tyre Company, the Polack Tyre and Rubber Company, and the proprietors of "Shell" motor spirit. There are championship prizes of £10 and £5 each for both petrol and steam drivers, whilst a large sum, estimated to exceed £250, will be awarded on parade in sums of £2, £1 10s., and £1. As in former years, the Continental Tyre and Rubber Company (Great Britain), Limited, have signified their intention of presenting a handsome challenge cup for the highest marked vehicle fitted with Continental "T" pattern solid tyres. It is claimed that these tyres are the most profitable on the market, and the manufacturers report an extraordinary demand for them, in order to cope with which they have had hydraulic presses laid down throughout the United Kingdom for the fitting thereof. The magnificent cups for 1911 and 1912 were won by Pickfords, Limited, and Thomas Tilling, Limited, respectively.

Petrol-Electric Cars Suggested for Hastings.—After a hearing extending from April 17 to 22, a Committee of the House of Lords threw out the bill promoted by the Hastings and District Tramways Company for the purpose of substituting the overhead trolley system for the Dolter surface-contact tramways on the sea front section of their tramways, the Board of Trade having on March 5 last intimated that at the end of six months they would issue an order for the discontinuance of the Dolter installation. Before the Committee gave their decision, counsel for the company stated that in the event of their lordships not passing the preamble of the bill the company were willing to leave the question to the Board of Trade. One of the witnesses called on behalf of the Town Council, who opposed the bill, was Sir Maurice Fitzmaurice, formerly chief engineer to the London County Council. He stated that had examined the track, which seemed to him to have been neglected. He suggested that if the conduit system were prohibitive, petrol-electric cars should be used. He thought that such cars could be made so as to avert passengers having to change at the overhead sections.

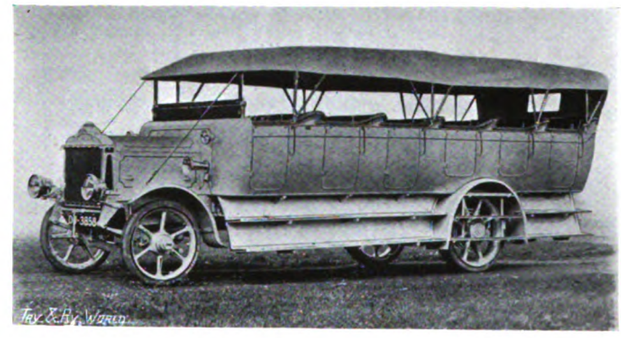
MOTOR TOURING SERVICE FOR NORTH WALES.

The New Brighton Motor Coach Company, Limited, have recently inaugurated a service of motor tours to the numerous beauty spots of North Wales. The accompanying photograph shows the enthusiasm which the inauguration of the service evolved. The mayors, and in most instances the mayoresses, of no fewer than ten boroughs in

Inauguration of Motor Tours in North Wales.

Cheshire and Lancashire and a distinguished company of local residents were present.

A run of between 60 and 70 miles through the charming and picturesque scenery was made, and, as showing the satisfaction given by the Daimler vehicles, we cannot do better than quote from the local newspaper's report of the trip: "Chief interest centred, of course, in



Chars-a-banc for North Wales Touring.
Body by Messrs. Stagg and Robson; Dunlop chassis.

the splendid touring chars-a-banc, a 40-H.P. vehicle with seating accommodation for 28 passengers. This car ran very smoothly, taking the gradients with practically no effort, and affording the utmost satisfaction."

The vehicles taking part in the run were a 40-H.P. Daimler chars-a-banc, a 40-H.P. Daimler omnibus, a 40-H.P. Daimler saloon car, and a 20-H.P. Daimler touring car.

Avon India Rubber Company.—This company have opened a branch office at 88, Avenue des Ternes, Paris, which will be under the control of M. de Lalande-Joulin. The telegraphic address is "Pneuavon, Paris." This is the sixth branch opened by the manufacturers of Avon tyres since the beginning of 1911.

The Dustless Road Cleaning Machine.—The motor-propelled road cleaning machine manufactured by Messrs. J. and P. Hill, of the Ordnance Works, Sheffield, was recently given a number of trials in the City of London. The approximate area of 24,000 square yards is dealt with per hour, and the trials substantiated the claims of dustless and effective cleansing put forward.

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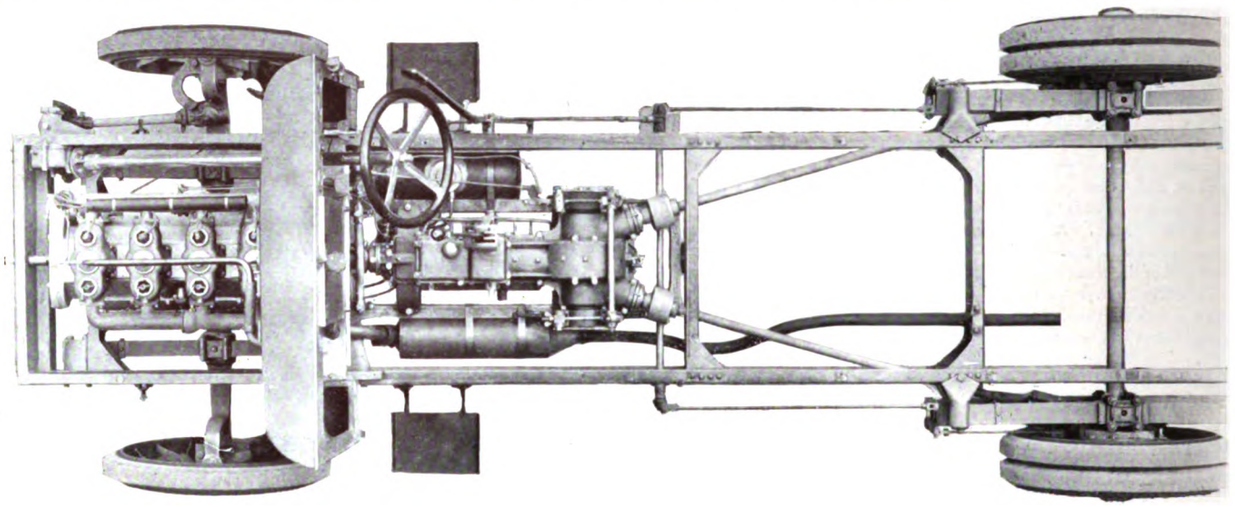
THE AUSTIN TWO-TON CHASSIS.

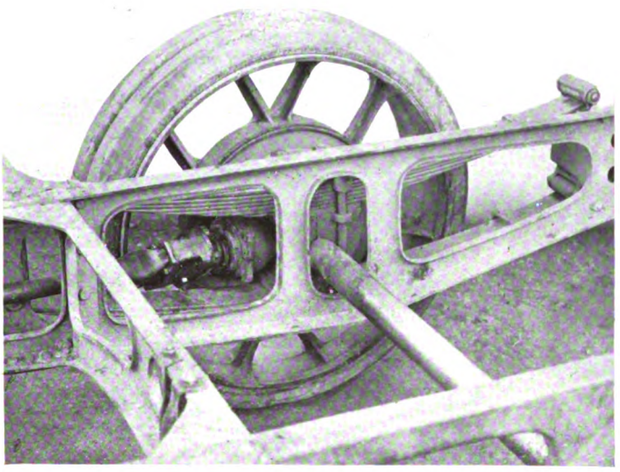
The new Austin commercial chassis presents certain features radically different from the makers' usual practice in methods of construction. Hitherto the Austin Motor Company, Limited, have confined their efforts to the production of private cars, ambulance vans, and a light delivery van to carry loads up to 15 cwts. Each of these models has earned an excellent reputation. Specially good reports are given of the 80 landaulettes which Messrs. Thomas Tilling, Limited, of London, have in regular service, and one of which was illustrated and described in our issue of May 9, 1912.

The design of the new industrial chassis, of which illustrations are now given, shows evidence of much thought and considerable originality, the main object being apparently to secure a low loading line. The frame is of open girder work construction, and a novel arrangement of the springs gives ideal suspension and at the same time ensures an unusual degree of lock for the front wheels, while the transmission and braking stresses are taken up without undue strains upon the rear springs. The front springs are located within the frame line, and are of the usual laminated semi-elliptic type, being anchored at their front ends. The rear arrangement is entirely new; two pairs of springs are used, one of each pair being placed below and the other above the axle, which, it will be noticed from our illustration, passes through the open work of the frame. The wheels are of cast steel, the front being riveted on to a flanged spindle of case-hardened nickel steel which runs in phosphor bronze bushes in the swivel head. Special features in the design of these wheels is the fact that they are so dished that the pivots are located directly over the points of contact between the tyres and the road, thus ensuring easy steering, and the entire absence of a protruding hub. The rear wheels are bushed and run on the axle tubes. The wheel base is 11 ft., wheel track 5 ft., and ground clearance 12 in. The chassis has a turning circle of 42 ft. The engine, clutch, gear box, and differential are all mounted on a sub-frame, and can each be inspected or removed without difficulty. As the radiator is at the back of the engine and forms part of the dash board, it is obvious that the removal of the bonnet renders the engine entirely free of access. The design and arrangement of the engine will be seen from the illustration. The gear box is of the constant-mesh type, giving four speeds forward and reverse, the speed changes being effected by dog clutches operated on the lever and gate principle. This is mounted direct on the gear box, and is placed on the left of the driver. The arrangement by which the final drive is transmitted to the road wheels constitutes the greatest departure from the general practice and is entirely novel. Each wheel is driven independently by means of a universally-jointed propeller shaft, and at the end of each shaft is mounted an enclosed bevel gear acting on the wheel direct. This method is claimed to give all the combined advantages of the chain drive and the worm or bevel live-axle drive without any of their disadvantages.

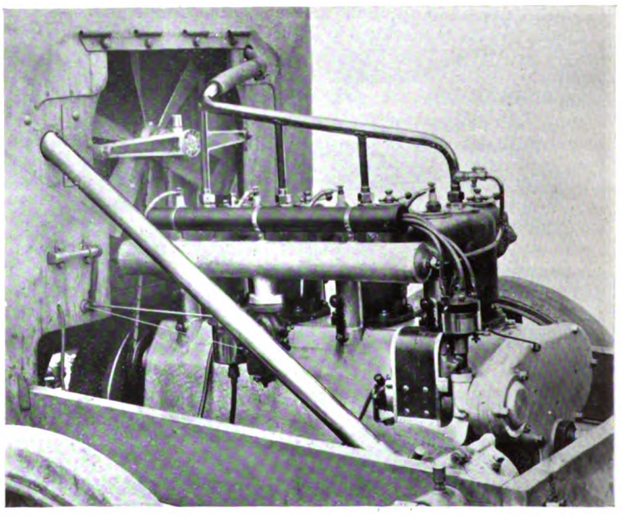
In addition to the hand lever brake operating on the drum of



Austin Two-Ton Chassis.



Part of Frame Spring and Drive to Rear Wheels.



Engine of Two-Ton Austin Chassis.

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the back wheels, the differential cross shaft carries at each of its extremities outside the rear end of the gear box a well-designed pedal-operated brake mechanism. Our illustration representing the plan view gives an excellent idea of the arrangement of each of the details of the power unit and transmission, and also the position of the double back springs.

Naturally, with so many alterations from what has become almost the standard practice, great care has been taken by Messrs. Austin to thoroughly test this chassis before placing the model on the market;

Austin Vehicle with Test Load.

our illustration shows the machine under test with a load considerably over the normal, and we are assured that, although subjected to the most stringent trials, it has behaved most admirably under all conditions. Messrs. Austin inform us that the trials have established certain points in favour of this chassis that makes it eminently suitable for service where speed and reliability are essential qualifications with a moderate load. In view of the fact, therefore, that both in regard to municipal authorities and railway companies the demand for "public service" motor vehicles is rapidly increasing, we shall expect to shortly see the new Austin chassis take its place in this important field for mechanical traction.

CONTINENTAL TYRE DEVELOPMENTS.

The well-known repair factory belonging to the Continental Company in Willesden has seen several alterations recently, owing to the fact that its previous capacities were not sufficient to cope with the business. This Company repairs covers of all makes, and they have now laid down some very fine machinery of the latest type in order that this work can be carried out in the shortest possible time and under the most efficient methods. The new machinery deals with repairs both of covers and tubes, and it is now possible for motorists to obtain the very last mile from any covers they buy if they are sent to this factory for repair, as no repairs are conducted unless the experts, into whose hands the articles pass, judge them capable of rendering very fair and reasonable service after the repair has been executed. All covers and tubes for repair, and all correspondence, should be addressed to 3-4, Thurloe Place, South Kensington, where, in addition to the warehouses and offices, the company have installed a large solid tyre press, capable of dealing with wheels of all sizes, so that vans can be driven into the "Continental" garage, solid tyres pressed off and new ones fitted while waiting. This plant is in addition to the press at Willesden.

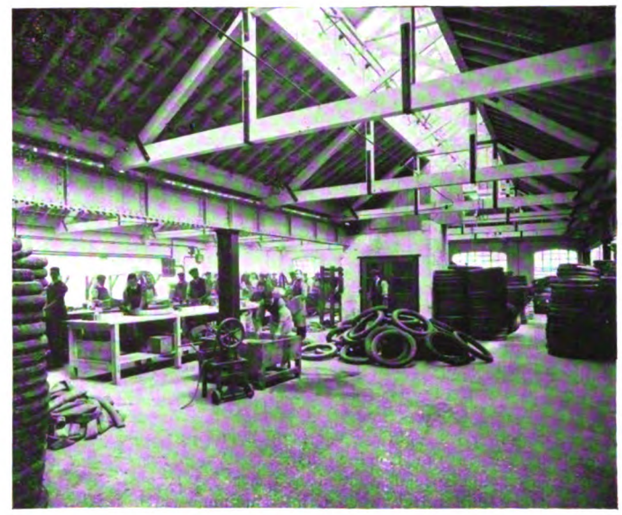
The mileages Continental tyres can give is evidenced by the fact that out of 543 solid tyres fitted to Messrs. Tilling's vans, whose whole fleet is fitted with Continental tyres, the average amounted to 18,346 miles per tyre, made up as follows:

Tyres.	Total Mileage.	Average Mileage.
39 (900 × 120)	764,870	19,612
169 (1,000 × 100)	3,221,792	19,063·8
105 (700 × 100)	1,626,972	15,495·2
230 (1,010 × 120)	4,388,467	19,080·3
Total, 543	Total, 10,002,101	Average, 18,346·4

Mr. Paul Brodtmann, managing director of this company, adds that even better mileages are expected from some hundreds of new solid tyres recently fitted to a large number of new London General 'buses.

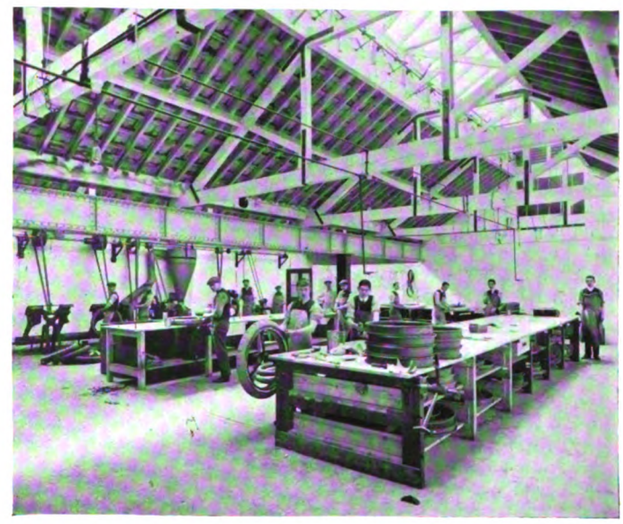
THE DUNLOP RUBBER COMPANY'S NEW PREMISES.

In order to cope with the rapid development of their solid tyre business in London and the South of England, the Dunlop Rubber Company have found it necessary to provide additional accommodation in the metropolis. The new establishment is situated in Belsize Road, Kilburn, adjacent to the London and North Western Railway Station,



Dunlop Rubber Company's New Works.

and will henceforth be the head-quarters of the solid tyre department. Large stocks of solid tyres in all standard sizes will be held, and electrically-driven hydraulic presses have been installed for the fitting of these tyres in the shortest possible time. The whole establishment will be under the direction of Mr. C. Rice, with Mr. M. Hanlon as works manager. Some idea of the growth of the company's solid tyre business will be gathered from the fact that in London alone there are



Dunlop Rubber Company's New Works.

nearly one thousand motor omnibuses fitted with Dunlop solid tyres, beside the large number of vehicles operated by various authorities, including Government departments, the Army Service Corps, H.M. Post Office, Crown Agents for the Colonies, the principal railway companies, the London County Council, and the City of Westminster Corporation. With such an extensive demand it has become impossible for the company to handle the solid tyre business from its depots at Regent Street and Clerkenwell Road, the resources of both these being

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already taxed to their utmost capacity to cope with the pneumatic tyre requirements.

The building acquired by the Dunlop Rubber Company is a substantial one of three storeys, with an imposing frontage and admirably constructed for the purposes it is intended to serve. It comprises some 30,000 square feet, divided into spacious workshops and stores, all conspicuous by reason of their lightness and airiness.

There is a large double gateway entrance to the works through which vehicles of any size can be driven right into the fitting shops, where wheels can be removed and tyres refitted under cover and without the delay usually associated with this operation.

The company employs a special motor lorry for the purpose of collecting customers' wheels in cases where it is inconvenient to bring the vehicles to the works, so that on receipt of a telephone message wheels can be collected, old tyres removed and new ones fitted, and the wheels redelivered to the customers' own premises in the shortest possible time. On the first floor is an extensive range of offices, in which is located the company's mileage recording staff. The system employed is an elaborate one, by means of which the life history of every Dunlop solid tyre can be inspected at any moment. A glance at the records shows not only the number and size of the tyre, and the customer to whom it has been delivered, but the service upon which it is engaged, the number of the wheel to which it is fitted, and the number of miles run week by week throughout its life.

Some of the mileages obtained on Dunlop solid tyres are really remarkable, mileages of thirty thousand to forty thousand miles being quite common, but it should be pointed out that in all cases where mileages such as these are obtained, it is found that the section of tyre employed is one of ample dimensions for the service required.

The company makes a special feature of large section tyres for heavy steam lorries. Many vehicles of this type are to-day running on Dunlop tyres in the London district. Another speciality of the company is the special studded non-skidding tyre for fire engines. This is a comparatively recent introduction, which has, however, been very successful, and exactly meets the special requirements of the motor propelled fire engine. Whilst the Kilburn premises are primarily devoted to the company's solid tyre business, accommodation is also found for the repair shops for the pneumatic tyres. In future, all kinds of repairs to pneumatic tyres, whether Dunlop or other make, will be undertaken at this depot, special arrangements having been made whereby these will be promptly handled by skilled workmen and returned to owners without delay.

Rejection of a Maidstone Motor Omnibus Scheme.—An application submitted to the Maidstone Council for licences for motor omnibuses proposed to be run in the town and district has been refused by a majority of two votes.

London Petrol Tramway Car Experiment.—At a meeting of Stepney Council on April 16 it was stated that within a month a trial trip would be made on the Burdett Road and Grove Road tramways with the horse cars which are being fitted up for petrol-electric traction.

Uses for Motor Omnibuses. The London General Omnibus Company are threatening extinction of the horse chars-a-bancs which convey excursionists on sight-seeing tours in London. The omnibuses do an increasing private hire business, the growth of which has been particularly shown on the occasion of the Association Football Cup Final during the last three years. On April 19 four hundred motor 'buses were chartered to convey excursionists round London. On Saturdays and Sundays motor 'buses are now run to Epsom *via* Tooting and Merton.

Automobile Engineers to Visit the United States. During the present month (May) the Institution of Automobile Engineers and the Society of Motor Manufacturers and Traders will send a large party of members to visit the United States, at the invitation of the American Society of Automobile Engineers. The hosts two years ago visited Great Britain, and the methods and manufactories then inspected have formed the subjects of numerous lectures given under the auspices of the American Society. The British visitors will travel by an American Transport Company's steamer from London, and will visit places as far apart as Washington and Detroit, making a trip into Canada as well. Three days will be spent on board the biggest passenger steamer on the Great Lakes on the occasion of the annual summer meeting of the Society of Automobile Engineers. These three days will therefore be divided up between the reading of papers and the visiting of places of interest on the Great Lakes.

IMPERIAL MOTOR TRANSPORT CONFERENCE.

The Hon. Arthur Stanley, M.P., chairman of the Royal Automobile Club and president of the Tramways and Light Railways Association, is chairman of the Executive Committee which has been formed to arrange an Imperial Motor Transport Conference, to be held during the third and fourth weeks in July next.

The conference will deal with motor transport, including all the industrial uses of motor vehicles, and not with the touring car and the use of the motor purely for pleasure. Invitations to attend are being sent out to all portions of the Empire. It is hoped that the Government departments interested in the development of road transport will be represented, and also that delegates will be representative of the industrial community, as for example, the chambers of commerce, trade societies, agricultural and planters' societies, carrying and coaching companies, municipal and road authorities, and important firms concerned in the engineering and motor trades. Prince Arthur of Connaught, who is acting as president, will receive the delegates on Friday, July 18, and on the following day the delegates will visit the Industrial Motor Vehicle Exhibition, organised by the Society of Motor Manufacturers and Traders, which will that day open at Olympia.

During the week visits will be paid to garages, depots, etc., where industrial motor vehicles are operated in considerable numbers, either for the carriage of passengers or for the transport or delivery of goods. The fact that the Industrial Motor Exhibition at Olympia will be open throughout the whole of the week should add materially to the value of the conference, since the delegates will be able to examine practical examples of all existing types of industrial motors. The Royal Automobile Club have kindly permitted the committee to make the club their head-quarters. The following questions will be discussed at the meetings:

1.—The question of fuel supply—present needs and future prospects—the possibility of creating adequate supplies within the Empire.
2.—The consideration of the problems of Imperial military motor transport with special reference to the production of types of vehicles, useful both for military work and for industrial work in the Dominions and Colonies.
3.—The organisation of motor transport systems for the carriage of goods, and their value to the mercantile life of the community. The adaptation of existing methods of delivery required to enable traders to take full advantage of the capabilities of mechanically-propelled vehicles.
4.—The relations between British manufacturers and buyers overseas. Desirable arrangements for satisfactory supply, agencies, etc.
5.—Road transport in cities. The carriage of passengers and the municipal uses of motor vehicles. Fire-fighting and ambulance services. Postal services.
6.—Rural transport and the uses of the motor to the agriculturist.

The president of the committee is H.R.H. Prince Arthur of Connaught, and the vice-presidents are the Rt. Hon. Lord Strathcona, High Commissioner for the Dominion of Canada; Rt. Hon. Sir George Reid, High Commissioner for the Commonwealth of Australia; the Hon. Sir Richard Solomon, High Commissioner for the Union of South Africa; and the Hon. Thomas Mackenzie, High Commissioner for the Dominion of New Zealand. The Executive Committee comprise the Hon. Arthur Stanley, M.P. (chairman of the Royal Automobile Club), as chairman; Mr. W. Worby Beaumont, consulting engineer to the Chief Commissioner of Police; Mr. F. Coates, consulting engineer to the Commonwealth of Australia and the Government of Victoria; Col. R. E. Crompton, C.B., consulting engineer to the Road Board, and chairman of the Commercial Motor Users' Association; Mr. J. Duncan Elliot, consulting engineer to the Dominion of New Zealand; Mr. R. M. Greaves, chairman of the Implement Committee of the Royal Agricultural Society of England; Mr. W. L. Griffiths, permanent secretary to the High Commissioner of Canada; Mr. W. Harvey, engineer to the Tasmanian Government; Mr. Ashton M. Heath, chief inspecting engineer to the Crown Agents for the Colonies; Mr. W. Joynson Hicks, M.P., chairman of the Automobile Association and Motor Union; Mr. H. G. Humby, consulting engineer to the Union of South Africa; Rt. Hon. Sir John H. A. Macdonald, K.C.B., president of the Scottish Automobile Club; Sir Charles Metcalfe, Bart., consulting engineer to Rhodesia; Sir Thomas D. Pile, Bart., director of the London General Omnibus Company; and Mr. J. Tearce, executive engineer to the Queensland Government; together with the following representatives of the Society of Motor Manufacturers and Traders: Mr. E. Manville (chairman); Mr. Sidney Straker, chairman of the Commercial Vehicles Committee, and managing director of Sidney Straker and Squire, Limited; Mr. R. Dennis, managing director of Dennis Brothers, Limited; Mr. F. Churchill, manager of automobile department, Messrs. J. and E. Hall, Limited; and Mr. T. Barry Cole, sales manager, Messrs. Commercial Cars, Limited. The hon. secretary is Mr. Horace Wyatt, and the assistant hon. secretaries are Mr. D. Bell and Colonel C. C. Townsend, R.A., at the Royal Automobile Club.

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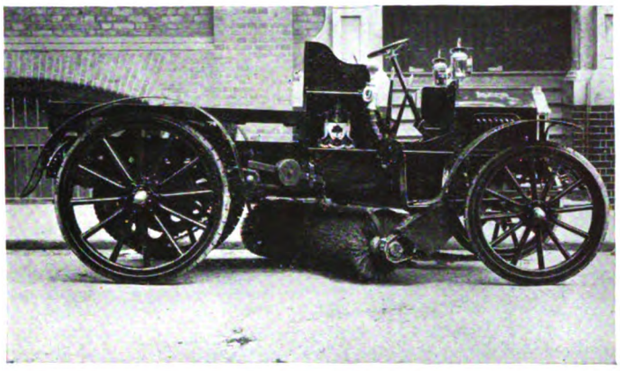
MOTOR TRAFFIC.

MOTOR ROAD SWEEPING MACHINE.

The Lacre Motor Car Company, Limited, of London, have supplied to the Glasgow Corporation the motor road sweeping machine here illustrated. The vehicle is fitted with the Lacre Company's standard type 18-H.P. 2-cylinder engine, the speed change gear providing three speeds forward and one reverse. The speed of the machine when not engaged in sweeping operations is four, eight, and thirteen



Motor Road Sweeper—Glasgow Corporation.

miles per hour, but when the brush is working the best speed for sweeping is about seven miles per hour, this being done on the second speed. For light surface sweeping on moist roads 10-12 miles per hour can easily be obtained. The diameter of the brush is 18 in. and the length 5 ft. Power to the road brush is transmitted through the sprocket shaft by means of a dog clutch engaging with the sprocket wheel, and is operated by a lever situated on the left hand side of the driver's seat in a very accessible position. The brush is raised and lowered by means of a lever, also situated on the left hand side of the driver's seat, and is controlled by an adjustable balance-weight situated on the off-side of the vehicle. An important feature of this road sweeper is the adjusting brackets on both sides of the brush shaft, which allow for adjustment and equal wearing of the brush. The wheels fitted to this machine are 40 in. diameter on the front, and 48 in. diameter on the rear.

MOTOR TRAFFIC NOTES.

A New Service in the Midlands.—The latest district to be served by the Tilling-Stevens petrol-electric omnibuses of the Birmingham and District Motor Omnibus Company is Oldbury, Langley, and Smethwick.

Manchester to Use Daimler Omnibuses.—The Tramways Committee of Manchester has accepted the tender of the Daimler Company for the supply of four motor omnibuses, which are to be used in opening up routes not at present provided with tramway facilities.

Olympia Industrial Motor Show.—The Industrial Motor Exhibition is to be held at Olympia from July 18 to 26 next. Mr. H. A. Blackie, of Maxwell House, Arundel Street, Strand, W.C., is the exhibitions manager of the Society of Motor Manufacturers and Traders, under whose auspices the exhibition will be held.

South Western Railway Road Motor Scheme Withdrawn.—It was announced on April 9 that the London and South Western Railway Company had withdrawn from their bill the clause which sought powers to provide and run road motor vehicles in connection with, or in extension of the railway system, or otherwise in any district to which the railway affords access. Sixty petitions from local authorities and transit undertakings had been presented against the clause. A modified clause was substituted.

Municipal Motor Vehicles for Nottingham.—A Local Government Board inquiry has been held at Nottingham into the application

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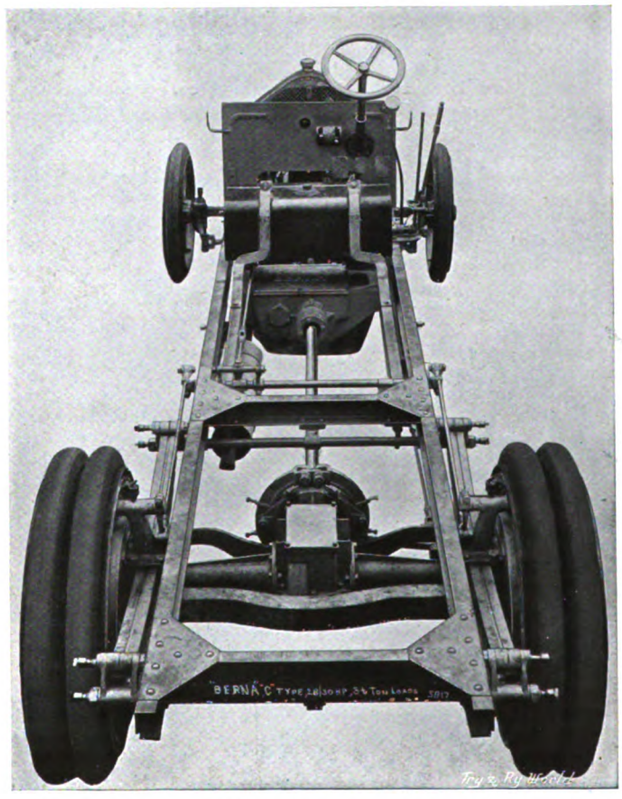

Berna 3½-Ton Chassis. Rear View Showing Differential and General Arrangement.

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MOTOR TRAFFIC.

of the Town Council to borrow the sum required for the purchase of motor vehicles for street cleansing and for haulage of materials. The Town Clerk stated that it was estimated that there would be a saving of about 25 per cent. on the cost of working the horse vehicles now used, besides a saving of time, which would enable the roads to be more frequently covered.

EFFECT OF ROAD MOTOR VEHICLES ON CANAL TRAFFIC.—At the half-yearly meeting of the Leeds and Liverpool Canal Company, Mr. Walbank, the chairman, stated that there was a modern development in transit which had already injured them severely, and threatened to have more effect as time went on. He referred to road motors, which were now carrying so much traffic which used to go by canal. It was impossible to say what would be the result of the working of the motors, but they must realise that it would be serious to them in depriving them of a considerable amount of the goods they now carried.

DUNLOP SOLID TYRES. Users of solid tyres for motor vehicles will be interested in the illustrated list of these tyres just issued by the Dunlop Rubber Company, who will be pleased to supply copies to all owners of commercial and industrial vehicles who write to the Manor Mills, Aston, Birmingham. Practical information is given on the care and use of solid tyres, and among the illustrations are tyres still in service which have run from 25,000, to 29,319 miles. Such results are obtained by fitting tyres of ample dimensions and by the exercise of reasonable care and attention. Photographs are given of Dunlop solid-tyred public service and other vehicles engaged in all parts of the country.

MOTOR OMNIBUS LIFE-GUARD ON TRIAL.—On some of the London General omnibuses running between Victoria Station and Seven Kings an extended trial is being given to a life-guard device. It consists of a shield made of laths of wood screwed on to the side of the vehicle between the two wheels, so arranged that while the whole of the back wheel is protected the shield inclines inwards towards the front, so that any person falling down alongside the vehicle will be pushed out of the way. Replying to a question addressed to him in the House of Commons on April 17, the Home Secretary stated that when a suitable device is discovered it will be imposed as a requirement of equipment on all motor omnibuses.

LEYTON RATE TO MEET OMNIBUS COMPETITION.—The district rate of 1s. 10d. in the £ made by Leyton Urban Council on March 27 is the highest which has been passed since 1906, and it is due to the Water Board deficit, the competition of the motor omnibuses with the tramways, and to the increased cost of road maintenance entailed by omnibus traffic. The chairman of the Finance Committee criticised the ratepayers for deserting the tramways in favour of a motor 'bus trust, earning dividends for shareholders, and not contributing a copper to the rates in respect of the use of the roads. Instead of the tramways giving £1,478, one-half of the actual profit earned during the year ending March, 1912, in aid of the rates, a sum of £637 has to be provided out of the current year's income to make good the deficiency on the working.

MOTOR FIRE ESCAPE VANS FOR LONDON.—At a meeting of London County Council on April 22 the Fire Brigade Committee reported on the question of the supply of motor fire escape vans. They reported that all the electrically-driven escape vans in use in the brigade had been supplied by Cedes Electric Traction, Limited, which was the only firm in the country undertaking the manufacture of complete appliances of this kind. The vans had proved satisfactory, and the company had accordingly been asked to tender for the supply of the two additional vans now required. The company's tender amounted to £1,668, including £50 for extras. The committee proposed that the tender should be accepted. The company proposed to sublet the supply of the batteries to the Tudor Accumulator Company. The report was adopted.

BEXLEY TRAMWAYS PREPARING FOR COMPETITION. The Council have adopted a scheme, prepared by Mr. H. P. Stokes, the tramways manager and electrical engineer, for an accelerated service, which came into operation on March 31. A pocket time-table is also to be issued. The only extra cost involved will be the charge for the extra current used. Mr. Stokes has consulted with the managers of the Dartford and Erith tramways with regard to effecting connections at the Market Place, but arrangements are not yet complete. Councillor Rattenbury informed the Council that the accelerated service would mean a saving in the waste of time and wages. Motor omnibuses were coming into the district shortly, and the tramways would not be in a position to compete unless the Council worked their cars in a businesslike manner.

BRISTOL TRAMWAY COMPANY'S MOTOR TOURS.—Mr. C. Challenger, manager of the Bristol Tramways and Carriage Company, has issued a pamphlet dealing with the 28 motor chars-a-banc tours which the company have arranged for the ensuing season. The scope presented for the use of public motor vehicles in Bristol, apart from the Bristol tramway service, is shown by a ten-mile observation tour of the city and Clifton. Other destinations include Mendip Hills, Wells, Glastonbury, Cheddar, Cheddar Gorge, Bath, Vale of Barrow, Gurney, the Wye Valley, Bournemouth, River Severn, Frome, Wotton-under-Edge, Weston Birt, across the Cotswold Hills, Great Malvern, Portishead, Clevedon, Stroud, top of Birdlip Hill, Stonehenge, Amesbury, Salisbury, Malmesbury, Chippenham, Cirencester, Oldbury-on-Severn, Weston-super-Mare, and Torquay.

LONDON GENERAL OMNIBUS STAFF DINNER.

The fifth annual dinner of the staff of the London General Omnibus Company was held on Saturday, April 12, in the Grand Hall of the Hotel Cecil, when a company of nearly 400 enjoyed an exceptionally well arranged entertainment. Mr. Charles J. Carter Scott, chairman of the board of directors, presided, and was supported by Sir Edgar Speyer, Sir T. D. Pile, Sir A. West, Sir Hugh Montgomery, Colonel G. F. Colville, Mr. A. H. Stanley, Mr. W. E. Mandelick, Mr. J. C. Mitchell, Captain Dumble, Mr. D. Duff, and the chief officers of the various departments. The chairman referred to the remarkable progress which the motor omnibus had made, and claimed that they now had the perfect vehicle for the London services. He deeply regretted the large number of accidents that occurred from time to time, and contended that the chief cause was that the public had not yet become accustomed to the more speedy vehicles. After some humorous references to the early days of the company, the chairman proposed the toast of the evening, "Success to the London General Omnibus Company."

Sir Edgar Speyer, Bart., in reply, said that he considered the company were to be congratulated upon the fact that the officials of the various departments worked together so harmoniously, and it was upon such foundations that the success of their organisation rested. Such a vast undertaking as theirs had now become needed special care and consideration to keep things going in a satisfactory manner, and the lubricant he recommended for use at all times was a combination of the essence of common sense, the spirit of fair play, and the milk of human kindness.

Mr. A. H. Stanley, in proposing "The Staff," paid high tribute to Mr. Walter J. Iden, the company's chief engineer, to whose constant care and splendid organising ability he considered the success of their huge undertaking was largely due. He deeply regretted his absence that night, the more so as it was in consequence of a breakdown in health, and was quite sure that all present would join him in hoping for his speedy recovery. Speaking of the staff generally, he said the company had every reason to feel proud of the way in which they performed their various duties. With the finest fleet of motor 'buses in the world, and their well-trained staff, he had no fear in regard to the future progress of the company.

Mr. A. Crane, manager of the company's body building department, replied for the staff, and in the course of his remarks thanked the directors for their institution of the superannuation fund, and assuring them that the staff were very grateful for their liberality in the matter.

Mr. Mandelick proposed the health of the visitors, and Mr. Mitchell the health of the chairman. An excellent programme of music had been arranged by Mr. H. Lansdown, the dinner secretary, to whom and his assistants were due the successful way in which the whole of the arrangements were carried out.

THE PROPOSED LONDON TRAFFIC BOARD.—The London County Council have decided to ask the House of Commons Committee on London Traffic to receive evidence from Sir E. White, chairman of the Highways Committee, as it seemed desirable that further evidence should be submitted of the Council's views as to the establishment of a Traffic Board on the lines recommended by the Royal Commission.

EDINBURGH AND SELF-PROPELLED CARS.—The Corporation on April 28 decided to send five members along with the burgh engineer to visit various English cities for the purpose of inspecting self-propelled tramway cars and motor omnibuses, and obtaining information on the subject. The Council have applied for a Provisional Order to give powers to run motor omnibuses, and the tramways company have offered to work the vehicles.

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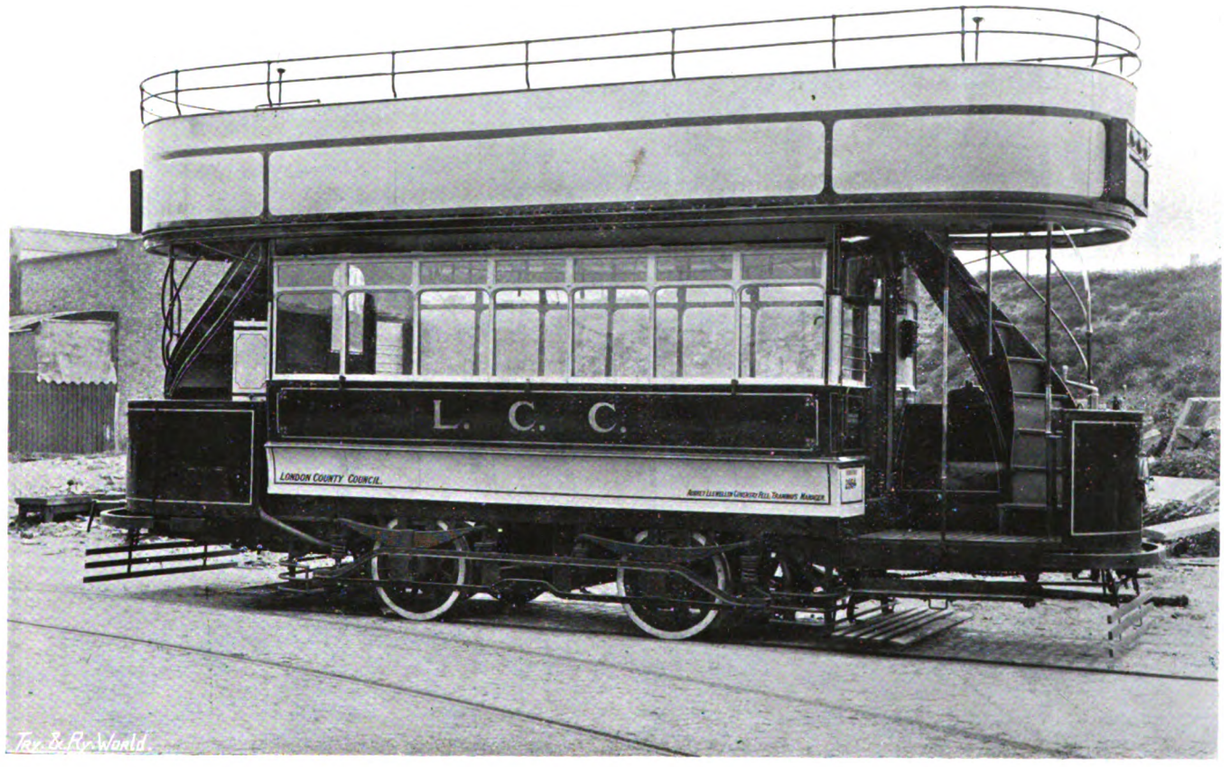
THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

ESTABLISHED 1892. LONDON, JUNE 5, 1913. VOL. XXXIII.

PETROL-ELECTRIC TRAMCARS.

TILLING-STEVENS CARS FOR THE LONDON COUNTY COUNCIL.

The opposition which some of the metropolitan boroughs have maintained against all proposals of the London County Council to make use of the overhead trolley system for tramways within their respective districts, has long prevented much-needed extensions of the Council's lines. The immense cost of the conduit system renders it prohibitive on routes where traffic is of moderate proportions, and the Council have for some time been desirous to find some other method of traction which, while not entailing the heavy cost of the conduit system, would be acceptable to the local authorities. Various systems have been tentatively considered, but about a year ago the success of the Tilling-Stevens petrol-electric system in motor omnibus service in London led the Council's advisers to determine upon an experiment with the same system applied to tramway cars. An opportunity to give the system a trial was presented by the urgent need for improvement in working a somewhat important route, now served by horse cars, from South Hackney to West India Docks. This is a cross-country section about 2¾ miles in length, and passes through the three metropolitan boroughs of Hackney, Bethnal Green, and Stepney, whose Councils persistently refuse their consent to overhead traction for this line. This route, which is of importance and increasing prospective utility, has up to now remained unelectrified. The Highways Committee estimated the loss in the first year if reconstructed on the trolley system of £1,730, and £3,910 if reconstructed on the conduit system, the capital cost being respectively £69,770 and £98,840.



Engine and Petrol Tank. Radiator.

Petrol-Electric Car—London County Council Tramways.

Last July the Highways Committee finally recommended the Council to abandon any attempt to obtain Parliamentary powers to equip the line on the overhead trolley system; and at the same time they proposed that three or four horse cars be altered and equipped with

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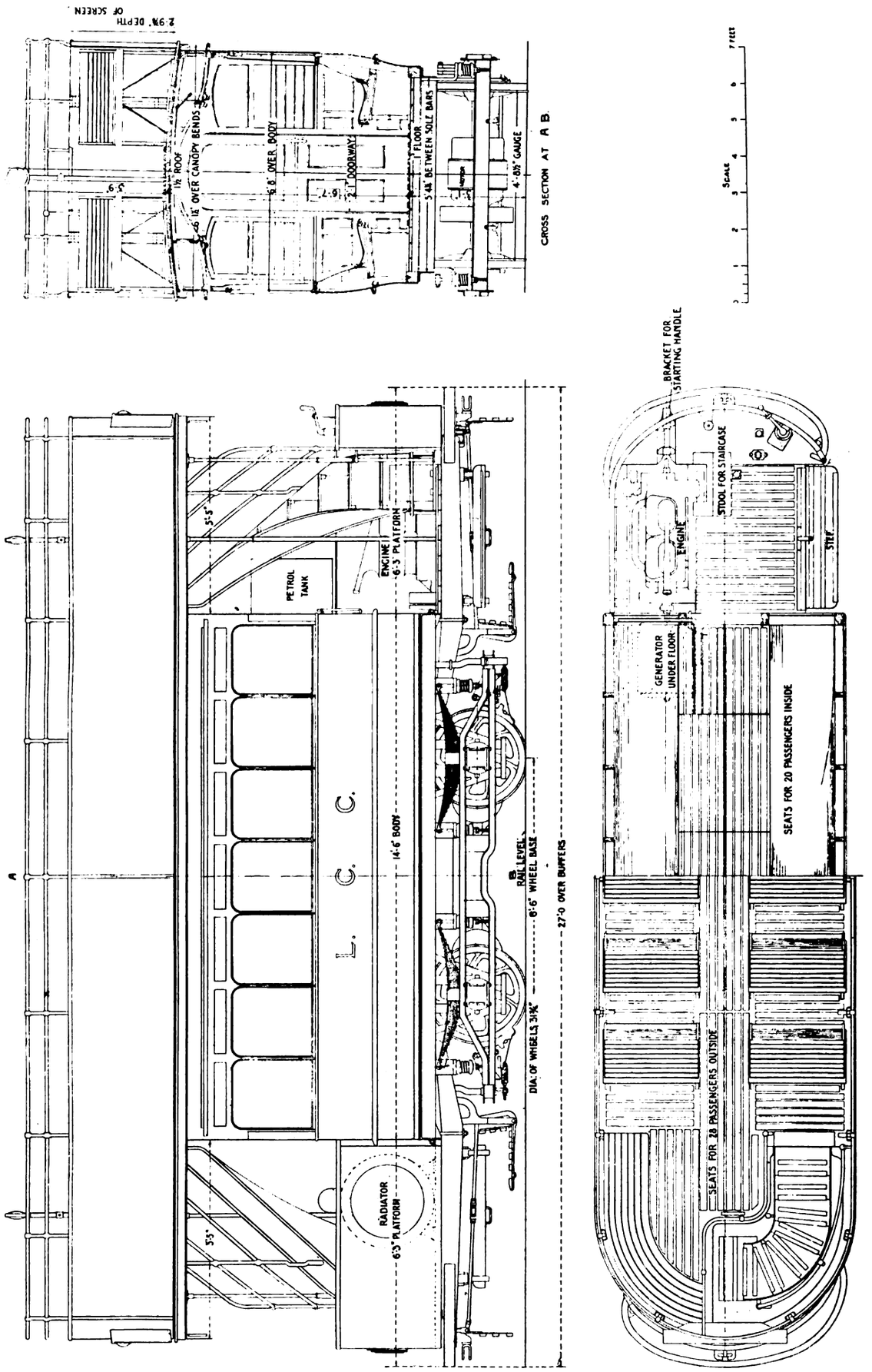

Plan, Side, and End Elevations of Tilling-Stevens Petrol-Electric Car—London County Council Tramways.

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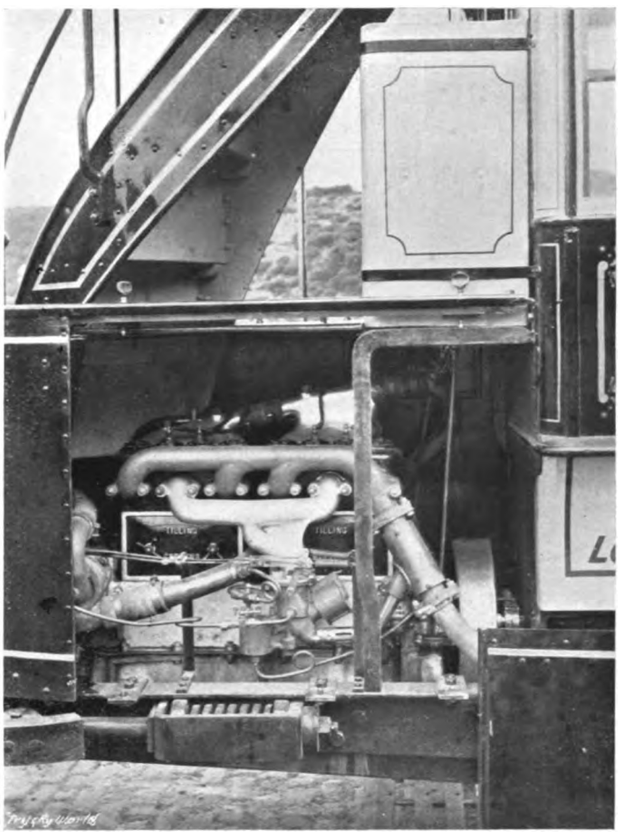
the Tilling-Stevens system. The Council forthwith agreed to the suggestion, and the cost of the experiment was set out at £2,400 or thereabouts. Statutory powers existed in the old North Metropolitan Tramways Company Act, 1890, and in order that the work could be put in hand at once the Board of Trade were asked whether they would approve of the adoption of the system. No objection to the proposal was raised by



Dash Removed to Show Petrol Engine with Electric Generator at Right—Petrol Tank Above.

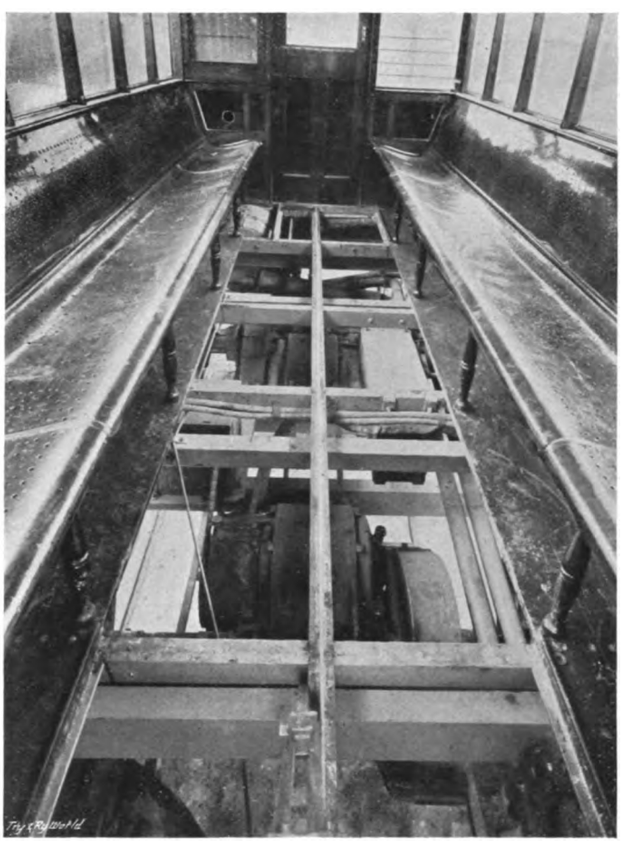
that authority, but having regard to the narrowness of the road at certain places, the Council were informed it would be necessary to prescribe somewhat lower rates of speed than are usual on wider roads.

It was then arranged that the supply and erection of the equipments required should be carried out by Messrs. W. A. Stevens, Limited, and the work of altering the cars be carried out by the tramways department by the direct employment of labour.

The work was soon taken in hand, and, considering the novelty of the undertaking, it has been completed in a remarkably short space of time. On May 7 a first trial trip and private inspection were made by a sub-committee of the Highways Committee under the supervision of Mr. A. L. C. Fell, the chief officer of the London County Council Tramways, and Mr. W. A. Stevens, managing director of W. A. Stevens, Limited. Subsequently the car was formally approved by the Board of Trade and representatives of the Metropolitan Police Department, the inspecting officers of each department making a close inspection of the machinery and brakes at the Central Car Works, and also accompanying the car on a short run on the London-Woolwich route, on a portion of which cars are permitted to attain a speed of 16 miles per hour. The route has a very frequent service of motor omnibuses, both double and single-decked, the latter being for the Blackwall Tunnel road. The electric tramcars are of the double-deck top-covered type, mounted on bogie trucks, and it is safe to say that their oscillation when running to the full speed limit exceeds that of the petrol-electric single-truck vehicle.

The arrangement of the whole of the apparatus is shown in the accompanying drawing and photographic illustrations. With much ingenuity room has been found for all the necessary equipment without in any way reducing the space that could be otherwise utilised. In fact, so little noticeable is the change that the casual observer would probably not detect any difference in appearance from the ordinary single-truck electric car. The only part of the original horse car is the body. New platforms and floors have been constructed, and the trucks have been specially designed and manufactured by the engineering department of the London County Council at the Central Car Repair Works at Charlton.

The 40-H.P. petrol engine and the whole of the electrical equipment, including electric motors, gearing, generators, and controllers, have been designed and manufactured by W. A. Stevens, Limited, of 26, Victoria Street, S.W., at their works at Maidstone. The two electric motors, one for each axle, are geared to the axle by a 6 to 1 reduction, and they are of the series-wound interpolar type. The maximum load on each motor is 20 B.H.P., but each is capable of developing 40 H.P. sparklessly for a considerable time.



View Showing Motors in Position.

The Generator is seen under the Seat at Left of the Door.

Either of the electric motors is capable of running the car on level roads.

The electrical generator is of the shunt-wound interpolar type and is in general of the same type as that used on the 40-H.P. Tilling-Stevens petrol-electric omnibus, the maximum voltage being about 350.

The petrol engine, which has a bore of $4\frac{3}{4}$ in. and a stroke of $5\frac{1}{2}$ in., develops well over 40 B.H.P. at 1,000 revolutions per minute. This speed is only necessary

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on hills; in ordinary service its average speed is about 700.

The engine and electrical generator are both mounted on a pressed-steel frame, which is suspended on the platform bearers at the end of the truck in such a way that the power unit is easily removable and can be exchanged in the case of a breakdown for a similar power unit in a short space of time. The water circulation is pump driven, and the radiator is on the platform at the opposite end of the car to the engine and electrical generator, but occupies the same relative position under the stairs. The fan of this radiator, which is of the popular Solex type, is mounted directly on the shaft of a small series-wound electric motor, supplied directly from the terminals of the electric generator. The fan is only in operation when the electrical generator is supplying energy to the motors, but as at all other times the engine is throttled down, the cooling is ample.

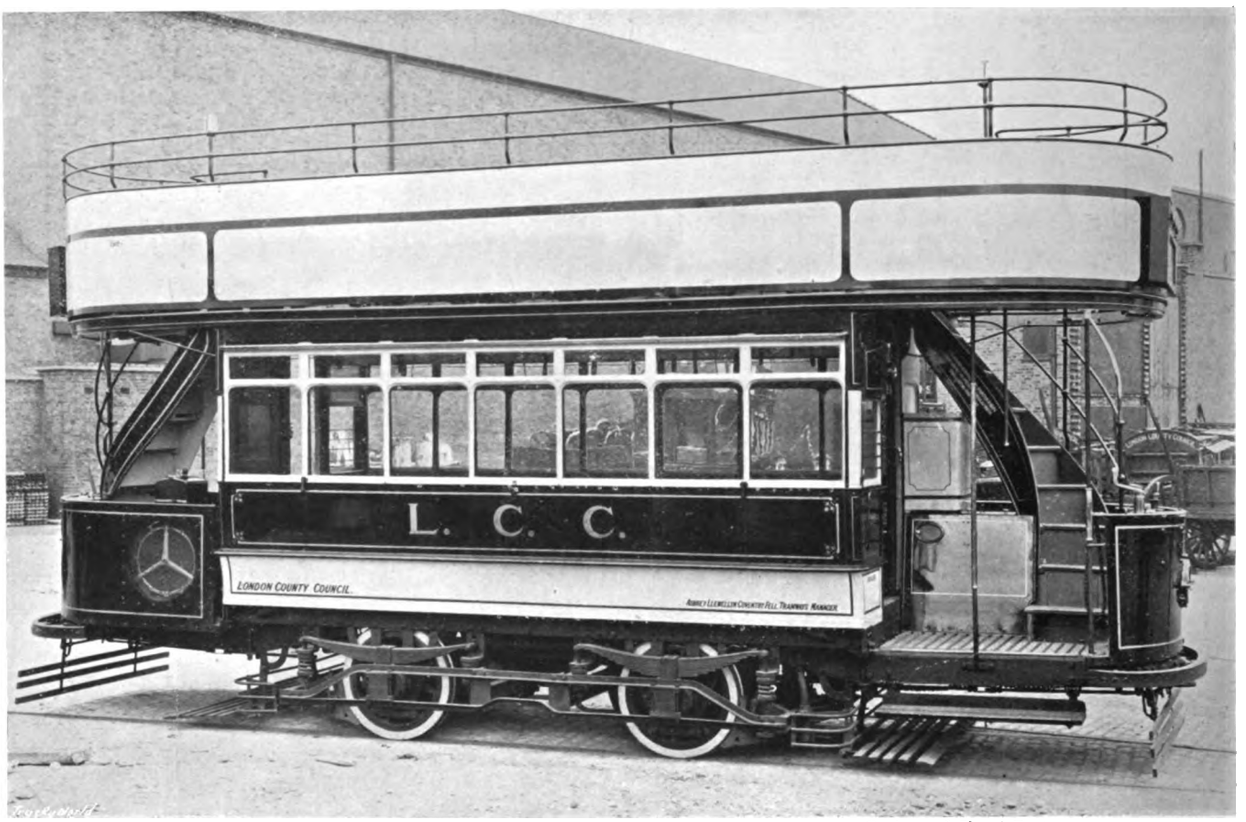
The control of the first three cars is effected by (1) the engine throttle, (2) a controller by which resistances can be put in circuit with the shunt winding of the generator, or alternatively the fields of the electric motors can be shunted by successive resistances. In addition, a reversing switch for the motor armatures is provided. The control is effected from either end of the car. In the present cars no magnetic brake is provided, but this can be easily arranged by a slight modification of the control apparatus.

It is possible to supply the motors from either the overhead or conduit supply as an alternative to the self-contained generator, so that cars so equipped can be run as either purely electric or petrol-electric.

Electrical lighting is provided by a small generator, which is placed under the floor of the car and driven by a belt from the motor, and a storage battery.

In regular service it is not intended that the speed shall exceed 12 miles per hour, but the car can be run at a much higher speed, and with a more powerful engine there is no reason why a speed of 40 miles per hour could not be maintained.

As in the Tilling-Stevens petrol-electric omnibus, no electrical circuits are made or broken in driving, and we found the acceleration in starting very smooth and rapid. The car runs, in fact, very nicely, and it is probable that the original three cars will be quickly supplemented by a number of others. The experiment promises to be very successful, and it will probably be found that the London County Council have introduced a method of traction that will rapidly be utilised in many places both in this country and abroad.



Radiator. Engine and Petrol Tank.

Petrol-Electric Car—London County Council Tramways.

EDINBURGH AND PETROL-ELECTRIC CARS.

On May 26 the deputation from Edinburgh Council who visited England to inspect self-propelled tramcars and also motor omnibuses, issued their report. With regard to reliability the report quotes the experience at Morecambe, where, with a mileage per car run during July of 2,200, and in August of 1,975, representing an average daily run of approximately 70 miles, the percentage of breakdowns of the Leyland petrol car was practically nil. The total expenses per car-mile of the Tilling-Stevens omnibus was 7·063d.

The introduction of the Tilling-Stevens petrol-electric car on the London County Council system was due to (1) the very high cost for local or branch service of the electric conduit system, and (2) the refusal of certain borough councils of the metropolis to permit overhead wires needed for the electric trolley-driven tramcar. Point is made of these preliminary difficulties encountered because of the similarity to the local experience in Edinburgh. The report concludes: "As regards the relative merits of the direct-driven petrol engine and of its compeer the petrol-electric combination, we are led to believe the latter an improvement upon the former, giving (*a*) ease of locomotion; (*b*) simplicity of control and drive; (*c*) silence of working. We were, however, impressed with the results obtained at Morecambe, and these cannot be disregarded in the maturing of our proposals. The success already obtained with the self-propelled car justifies its introduction (experimentally) to the city of Edinburgh. It apparently affords the prospect of adaptation to the existing tramway service of the city."

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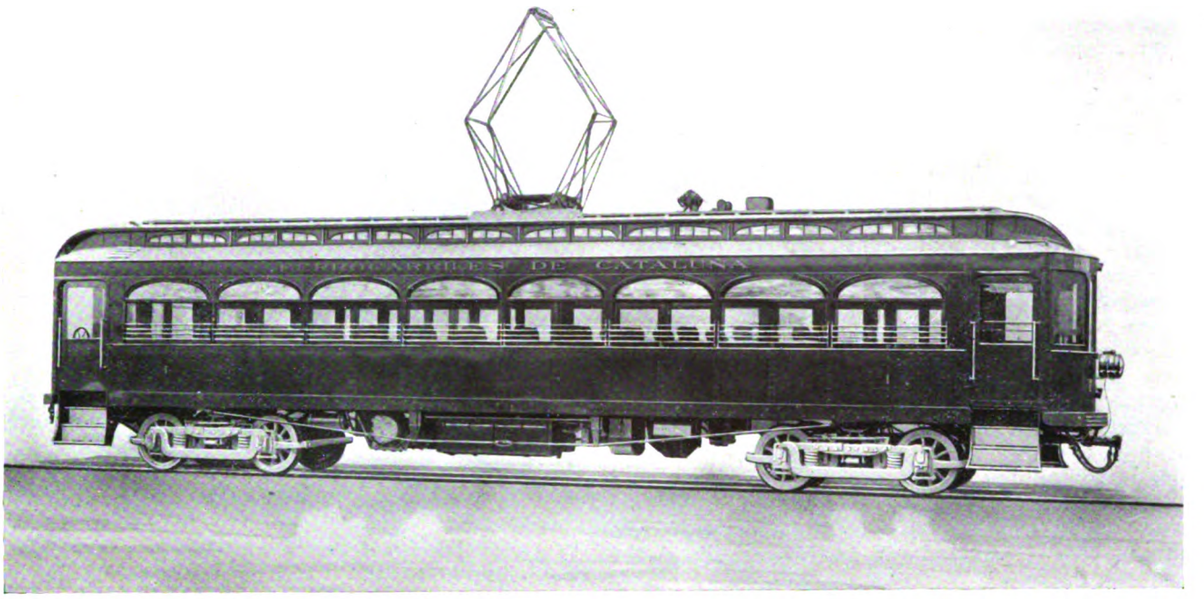
INTERURBAN CARS FOR HIGH-TENSION DIRECT-CURRENT WORKING.

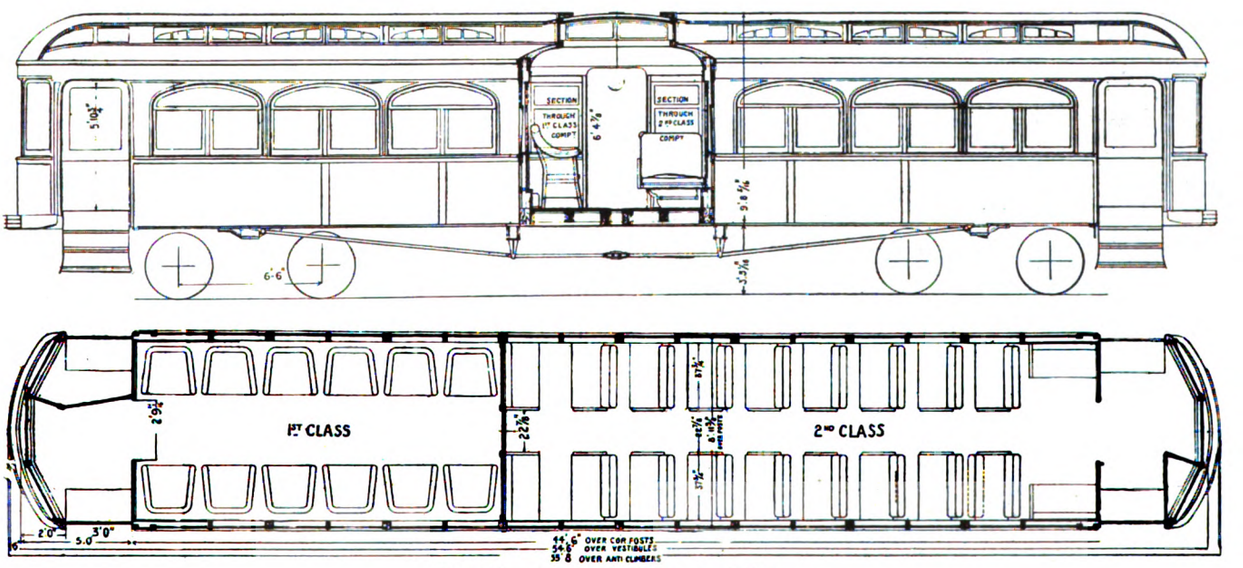
It is quite a long time since experiments began abroad with the use of high-pressure direct current for electric railway working, and the system is now a pronounced success. Strangely enough no example of the method is yet in operation in this country, though it is well known that it possesses many advantages, especially for lines of considerable length. The Lancashire and Yorkshire Railway's high-tension direct-current experimental line at Bury should, however, soon be working, and then British data will be available. Meantime it is interesting to note that Spain—usually supposed to be a backward country—now possesses a railway of the kind, the Ferrocarriles de Cataluna, an interurban electric railway running between Barcelona, Sabadell, and Tarrasa. The purpose of the present article is to describe two fine interurban cars of large size which have recently been built for this railway by the J. G. Brill Company.



Bogie Car for Spanish Railway Worked by 1,200-volt Direct Current.

Barcelona, with a population of 587,000, is the largest commercial and industrial town in Spain. Sabadell and Tarrasa, reached by the electric railway, are important suburban points. The railway is worked both at 600 volts and 1,200 volts direct current, the higher potential being used in country districts and in a long tunnel, and the lower in the towns.

The new interurban cars are of an unusually sturdy and symmetrical design, and embody refinements that are expected to lead to most efficient operation. The twin windows have opalescent glass in the upper part, and the lower sashes are made to remain at any height. Bulkhead doors are not used, but there are openings 2 ft. $9\frac{1}{16}$ in. wide. The seats are upholstered in dark green figured plush, and have high triple-bolster backs. All woodwork is mahogany, and the ceiling is aluminium, painted a light blue. Ornamental clear-story side drop lights and a row of incandescents along the centre



Elevation, Cross Section, and Plan.

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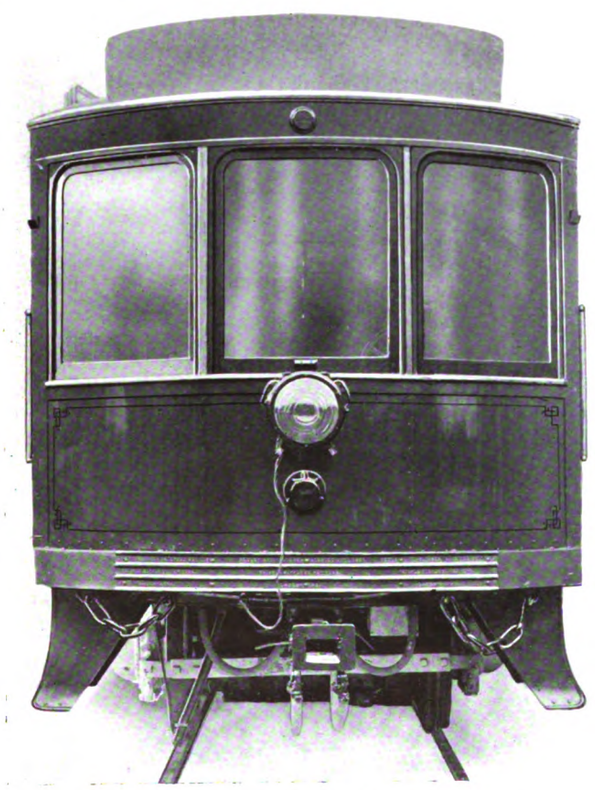
furnish artificial illumination. The centre row of lamps is connected with a storage battery that cuts in automatically whenever there is an interruption of propulsion current. Bronze parcel racks are placed over the seats in pairs, and each side post has a signal button.

The platforms, which are 5 ft. long, are vestibuled, and have sliding doors and triple-tread steam-coach steps on both sides. To the right of the centre vestibule window, on each platform, is a partition 1 ft. 7 in. long, with glazed upper panel, to which is hinged a two-leaf folding door. The sliding vestibule doors are actuated by air, and all four can be operated by two valves from either platform. One valve is in the motorman's cab, and controls the front and rear platform doors on his left; the other, which is in front of the centre vestibule window, controls the doors on his right. A sheet-steel trap is attached to each door, and when closed in passing through cities the trap covers the step opening, but is inclined about 45 deg. As soon as air is admitted to the operating mechanism the trap is drawn up against the door, after which the door moves back into its pocket. The usual type of trap door is also furnished, but is used only on interurban runs where stops are infrequent. The pantagraph trolley is maintained in its elevated position by springs, and lowered by air.

The body framing is ash, with $3\frac{5}{8}$ in. corner, and $2\frac{1}{4}$ in. and $4\frac{1}{2}$ in. side posts. Upper and lower window rails are made in one piece and, together with steel sheathing below the windows, add materially to the



End View of Car for 1,200-volt Direct-Current Working.

rigidity of the structure. The monitor roof is supported on ash carlines, reinforced by concealed steel rafters.

The superstructure is built on a composite bottom frame. The side sills are $4\frac{1}{4}$ in. by $8\frac{3}{4}$ in. yellow pine, reinforced on the inside with a $\frac{3}{8}$ in. by 15 in. steel plate. A $2\frac{1}{4}$ in. by $8\frac{3}{4}$ in. yellow pine subsill, in two lengths, is bolted to the outside of the side sills, and is reinforced along its entire lower edge with a $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in. by $\frac{3}{8}$ in. angle. As the car is arranged for dismantling for over-sea shipment, the side posts are tenoned into the exterior subsills, so that they may be removed in one piece, and the bottom frame remain intact. In addition to the side sills there are two 7 in. I-beam centre stringers, with yellow pine filler, and

Interior View.

two 5 in. I-beam intermediate stringers with fillers of the same material. These stringers come above the conical roller side bearings under the body bolsters, and in passing through the bolsters reinforce the compression members at those points. The stringers run through from bumper to bumper, and, therefore, the end sills, which are 5 in. by $5\frac{1}{4}$ in. white oak, consist of five distinct lengths, tenoned into the side sills and wood fillers. Along the under side of each end sill is a 7 in. by $3\frac{1}{2}$ in. by $\frac{1}{2}$ in. angle, extending the full width of the body, to transfer the weight of the sides to the centre and intermediate stringers. Oak crossings, $3\frac{1}{2}$ in. by $5\frac{3}{4}$ in., are placed between the longitudinal members in the same manner as the end sills. All joints in the bottom frame are strengthened by corner irons. A 7 in. by $3\frac{1}{2}$ in. by $\frac{1}{2}$ in. Brill angle iron bumper, and an anti-climbing device, are provided at each end.

The car is mounted on Brill No. 27 high-speed interurban trucks, capable of a speed of 60 miles per hour.

The following are the principal dimensions, etc.:

	ft.	in.
Length over corner posts	44	6
Length over vestibules ..	54	4
Length of platforms ..	5	0
Centres of side posts ..	2	8
Width over sills	8	$11\frac{3}{8}$
Width over posts ..	8	$11\frac{3}{8}$
From track to side sills .	3	$3\frac{1}{16}$
From side sills over trolley boards	9	$8\frac{5}{16}$
Track to step	0	$16\frac{5}{16}$
From floor to centre of head lining	8	$7\frac{3}{4}$
Step to step	0	$10\frac{1}{2}$
Step to platform.. ..	0	$10\frac{1}{2}$

Seating capacity	64
Type of trucks– Brill No. 27-MCB2	
Wheel base	6 ft. 6 in.
Diameter of wheels ..	36 in.
Size of journal	$4\frac{1}{4}$ in. by 8 in.
Type of motors, GE205—47·5 H.P.	
Weight of car body, less electrical equipment ..	28,278 lb.
Weight of electrical equipment ..	4,300 lb.
Weight of air-brake equipment	3,000 lb.
Weight of trucks ..	20,858 lb.
Weight of motors ..	14,804 lb.
Total weight	81,240 lb.

Buenos Aires Tramways.—The monthly bulletin of Municipal Statistics of Buenos Aires gives the following particulars of electric tramways for the month of February:

Companies.	Length of Lines.	Total No. of Cars.	Number of Employees.	Passengers.
Anglo-Argentine	336·4	1,737	9,935	28,187,654
Lacroze of Buenos Aires, Ltd....	59·1	220	1,130	5,011,389
Southern Electric Company ...	9·1	62	242	235,817
Port and City of Buenos Aires...	26·00	51	306	682,442
Totals	430·6	2,070	11,613	34,117,302

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LONDON PASSENGER TRAFFIC IN 1912-13.

By A. J. Lawson, M.Inst.C.E.

It appears from the agenda of the London County Council meetings which have been held within the last 12 months, that the total number of passengers carried by the Council's tramways in the year which ended on March 31 last was 512,952,005, and the traffic receipts were £2,180,735. These figures represent a reduction of no less than 20,488,230 in numbers and £111,524 in receipts, with an average fare of 1·020d. as against 1·031d. in the preceding year.

This reduction in average fare is in part due to the reduced prices caused by the system of return tickets, introduced to meet the omnibus competition, and in part to the increased number of people carried at workmen's fares, the rapid rise in whose numbers is shown hereunder:

	Total.		Total.
1902-3	—	1907-8	27,977,412
1903-4	—	1908-9	32,083,034
1904-5	9,898,289	1909-10	36,354,326
1905-6	13,011,473	1910-11	42,830,597
1906-7	19,528,799	1911-12	45,978,203

(For the latter year the London Traffic Branch of the Board of Trade give the number as 61,866,125; but an increase of 19 millions in one year appears improbable.)

The number of people carried by the tramways would also have been greater but for the breakdowns of plant at the Greenwich power-house in the latter month of the financial year, which necessitated the withdrawal of 120 cars from the lines south of the Thames and the temporary dislocation of the whole system. The lack of spare plant, and the incompleteness of the lines throughout the County Council area are two of the main causes of last year's set-back. Without such aids an increase of 115,000,000 in omnibus passengers would have been impossible.

As it is the tramways of Greater London, instead of having a natural increase, have lost 26,000,000 passengers in the year, the local railways about 8,000,000 in actual numbers instead of obtaining a normal increase, and in addition, the omnibus companies have secured 80,000,000 more passengers in the central London districts where no tramway competition is permitted.

The total number of omnibus passengers for the past year was in round figures 517,000,000, or about 4,000,000 more than the total number of County Council tramway passengers, but still 275,000,000 short of the total number of all passengers on tramways in Greater London, though the number of omnibuses and tramcars in use throughout the year averaged 2,700 of each.

The total numbers of passengers carried by various transport systems in London in the past year are set out below in parallel columns with those of the previous year for comparison:

	Passengers Carried.	
	1911-12.	1912-13.
Tramways:		
London County Council ..	533,440,235	512,952,005
Metropolitan Electric	89,908,677	91,508,693
London United	62,547,128	61,139,285
South Metropolitan	7,478,568	7,385,589
Croydon Corporation	20,849,230	20,504,143
Local London Railways	436,488,785	428,812,310
London General Omnibus Co. ..	(not given)	487,221,629

The number of omnibus passengers in 1911 as given by the Traffic Branch of the Board of Trade was 400,628,487, carried by the London General Omnibus Company and five other companies.

The figures for the tramways in east and south-east London, outside the county of London, for last year are not yet available, but the total may be taken as 100,000,000, or slightly over.

The average fares on railways, omnibuses, and tramways for the past year were as under:

	Average Fare.
District Railway	1·821d.
London Electric Railway	1·698d.
City and South London Railway	1·570d.
Metropolitan	1·498d.
Central London	1·371d.
North London Railway	1·318d.
London General Omnibus Company	1·322d.
London United Tramways	1·261d.
Metropolitan Electric Tramways	1·208d.
London County Council Tramways	1·020d.

It may also be mentioned that on the County Council Tramways, 27 per cent. of the passengers are carried at the very low fare of ½d., and 46 per cent. at 1d., 10 per cent. each at 1½d. and 2d. respectively, only 7 per cent. of the total being carried at higher fares.

The Metropolitan Electric Tramways were able to maintain the passenger revenue at exactly the same figure as in the previous year, viz., £460,544—one of the most remarkable coincidences in traffics which has ever occurred in the history of transport—by running their cars 1,049,757 more miles than in 1911, and thereby securing 1,600,016 additional passengers—another strange coincidence in figures—but at the lower fare of 1·208d. as against 1·230d. or ·022d. per person less than in the previous year, the number of passengers per car-mile being 7·969 compared with 8·618, and the receipts from traffic 9·626d. as against 10·594d. per car-mile in 1911. Though the cost of running was reduced from 6·452d. to 6·380d. per car-mile, the additional working expenses are higher for the year by £24,348 10s. 11d., but the receipts from other tramway sources are higher by £12,858.

In the case of the London United Tramways the passengers carried were fewer by 1,407,843 and the average fare was lower at 1·261d. per passenger compared with 1·290d. in the previous year.

POWERFUL ELECTRIC LOCOMOTIVES FOR THE NEW YORK CENTRAL RAILROAD.

The New York Central and Hudson River Railroad, which has an electric zone extending from the Grand Central Station in New York City to Poughkeepsie, a distance of about 60 miles, probably deals with the heaviest electric service in the world. The trains are hauled by electric locomotives equipped with 600-volt direct-current. motors, and energy is transmitted by third and fourth rails, as on most of the electric railways in this country. The electric locomotives which have been used hitherto have weighed 115 tons, but only 70 tons was carried by the driving wheels. More powerful machines being found desirable, the company are obtaining from the American General Electric Company 19 locomotives which, as far as we are aware, are rightly described as the most powerful electric locomotives yet constructed. Ten of these machines are already in service, and they weigh 100 tons each, the whole of the weight being carried on the driving axles. Their tractive effort is sufficient to haul a train of 1,000 tons at 60 miles per hour, while in regular service they develop 1,400 H.P. continuously. For short periods they can develop as much as 5,000 H.P. The main feature in these new engines is the addition of motors to the bogie trucks and the elimination of ineffective weight, so that every pound of the locomotive weight is to be instrumental in producing adhesion and tractive effort. A still greater separation of the fixed wheel base and the guiding trucks lengthened

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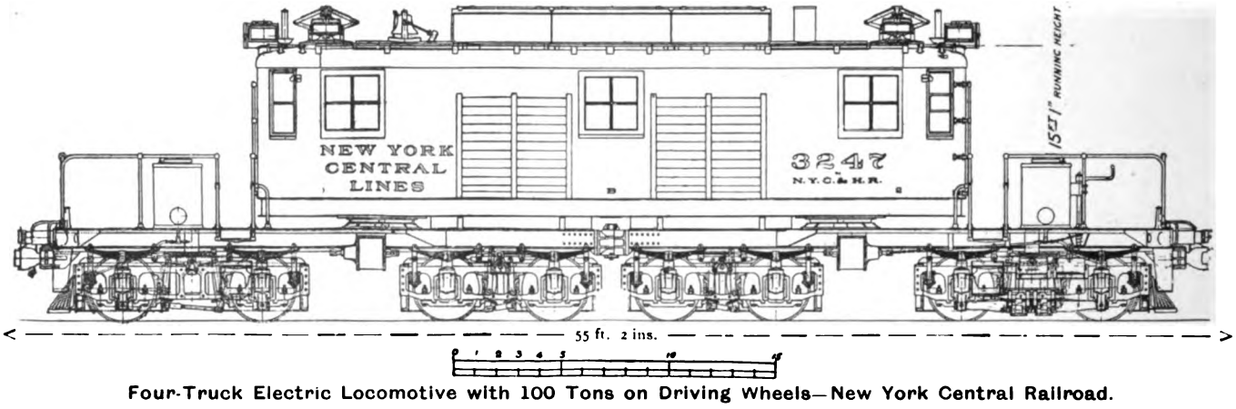
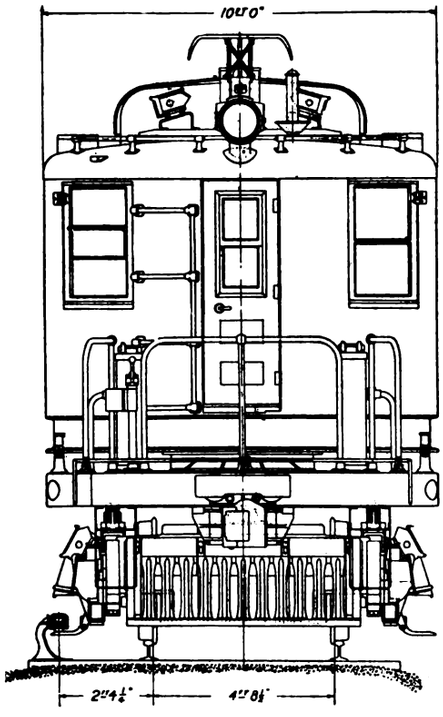
the machine so as to make it necessary to construct the running gear in two halves with a spring-connected articulated joint between the frames.

At the present time the New York Central is working 47 electric locomotives in the New York terminal service. Of these, 35 were built in 1906 and twelve in 1908. They are all of the 115-ton 4-8-4 type, and are each equipped with four GE-84 bipolar gearless motors. The new electric locomotive is likewise a bipolar gearless design, but it is equipped with eight GE-89 motors and, as will be seen from the accompanying drawings, is of the 4-4-4-4 type. Each motor is approximately three-fourths the capacity of the GE-84 motor used on the previous engine, making the aggregate capacity of the motors on the locomotive approximately 50 per cent. greater than before and affording approximately 25 per cent. higher speed.



Four-Truck Electric Locomotive with 100 Tons on Driving Wheels—New York Central Railroad.



End Elevation.

In general, the locomotive may be described as having an articulated frame with bogie guiding trucks at each end. The cab containing the engineer's compartment and that for the operating mechanism is swung between the two parts of the frame on the centre pins. Each section is equipped with two two-axle trucks having a driving motor mounted on each axle. These cannot be distinguished as main, driving, or leading trucks, since all the axles are driving axles; but they are termed for clearness, rigid trucks and swivel trucks respectively.

The rigid truck is built up of heavy steel castings, the side frames being of a truss pattern with heavy top and bottom members and pedestal tie bars. The magnetic circuit of each truck consists of the armatures mounted on the axles, the magnet poles carried on the end frames, the side frames and an additional magnet bar forming a path in parallel with the side frames. The whole weight of the truck is carried on semi-elliptic and coil springs resting on the journal boxes and equalised together.

The main frame, or backbone of the locomotive, is a box girder built of 10 in. channels with ¼ in. top and bottom plates. It is approximately 10 in. deep by 36 in. in width and 22 ft. in length. The frame is bolted to the top member of the rigid truck. The main frame carries in its top plate the centre pin which supports the weight of the cab. All these centre pins are hollow and serve as air passages, the main box girder frame acting as a distributing reservoir for the air delivered from the blower in the upper cab through the upper centre pins and conducting it to the eight motors below. The construction of the swivel or leading truck is similar to that of the rigid truck. This type of design affords a long flexible wheel base with eight axles, but restricts the length of any portion to not more than 6 ft. 6 in. All the axles are equipped with motors, but the magnetic circuit for each truck or pair of motors is self-contained and relates only to the two axles in that truck.

The cab, carried on the two centre pins, has its weight distributed between the two halves of the locomotive frame. It is of the box type, 33 ft. in length and 10 ft. wide. The interior is divided into three sections. A motorman's compartment is situated at either end and contains the motorman's seat, controller, air brake, valves, bell and whistle, rope handles, and such parts of the control apparatus as have to be within easy reach of the motorman. In the central section of the cab are the air compressors, blowers, contactors and rheostats, grouped so that they are conveniently accessible for inspection and repair, and separated from the direct reach or attention of the operating engineer.

The principal data and important dimensions applying to the locomotive are the following:

Length over all	35 ft. 2 in.
Length over cab	33 ft.
Height over cab	12 ft. 8 in.
Height with trolley down..	14 ft. 6 in.
Height with trolley running	15 ft. 1 in.
Width over all	10 ft.
Total wheel base	45 ft. 7 in.
Rigid wheel base	5 ft. and 6 ft. 6in.
Total weight	200,000 lb.
Weight per axle	25,000 lb.
Dead weight per axle	6,395 lb.

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The eight GE-89 bipolar gearless motors each have the armature mounted directly on the axle. The field poles are carried on the truck frame, which forms the magnetic circuit. There are four independent magnetic circuits in the locomotive corresponding to the four trucks. The magnetic flux path on each truck passes in series through the fields and armature of one motor, through the centre transom and the fields and armature of the second motor to the end frame, and then returns to the starting point through the two side frames and a reinforcing magnet bar lying parallel with the frames.

Each field coil is wound in a brass shell, the windings being in two decks of flat ribbon copper laid side by side. The outside turn is covered with insulation and an armour of sheet steel is clamped over it, filling the space between the sides of the shell in such a way as to protect the windings from water or mechanical injury. End shields are provided for each motor, which render it dust-tight and as nearly water-tight as is possible in any motor design with necessary outfits for forced ventilation.

Each motor at its one-hour rating has a capacity of 325 amperes on 600 volts, or a continuous rating of 260 amperes on 600 volts under forced ventilation. For the complete equipment of eight motors, this corresponds to a capacity of 13,500 lb. tractive effort at 54 miles per hour for the one-hour rating, and 10,000 lb. tractive effort at 60 miles per hour continuously. The motors are electrically connected permanently in parallel in pairs, and the pairs can be connected in three combinations, viz., series, series-parallel, and parallel. They are insulated for 1,200 volts, so that if at any future time it should be desired to operate the locomotive on 1,200 volts, the pairs of motors could be changed from parallel to series connections and the same speeds and control combinations obtained as on 600 volts.

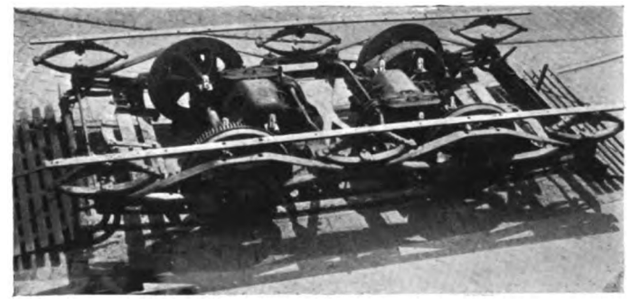
The control equipment on the locomotive is the Sprague-General Electric type M, and is designed to operate the eight motors connected in the three combinations; series, series-parallel, and parallel. The pairs of motors with their respective resistances are connected all in series on the first point of the controller. The resistance is varied through eight points on the controller, and finally short-circuited on the ninth or running point. The pairs are then operated similarly in series-parallel with all resistance cut out on the seventeenth point. Finally, all the pairs are connected in parallel with the twenty-fourth step a running point. This provides a control with nine steps series, eight steps series-parallel, and seven steps parallel.

The transition between series and series-parallel is effected without opening the motor-circuit, and there is no appreciable reduction in tractive effort during the change. The smooth transition between points, both rheostatic and transitional, permits motor operation close to the slipping point of the wheels. The locomotive weight on the drivers is so proportioned that the motors operate safely up to the slipping point, which serves as a limit to prevent overloading the motors. The transition between all four pairs of motors in series to series-parallel is accomplished by short-circuiting two of the pairs of motors during the instant of transfer. The transition between series-parallel and parallel is effected by means of the standard bridge method. The motor cut-out switches are connected so that any pair of motors may be cut out of circuit.

Current is collected by eight under-running third rail shoes, or by two overhead trolleys, when on gaps on the third rail. The overhead trolleys, are of the pantograph type and are pneumatically operated. They can be put into service from either motorman's position by a foot-operated valve. The trolley is designed for intermittent use, and is therefore arranged to be held in a raised position only while the valve is held open by the engineer's foot. There is a complete system of lighting and heating, and other fittings, including pneumatic sanders, bells, etc., are provided.

THE MENNO GREASE CUP.

In our issue of April 10 some particulars were given of a new form of grease cup which has recently been placed upon the market by Lubricators Limited. We have now received a copy of a report from Mr. W. Grant, general manager of the Ayr Corporation Tramways, who has been carrying out some lubrication tests on his cars, which show some notable results. The car to which the Menno grease cups were fitted is a four-wheel double-deck standard type car with British Thomson-Houston G.E. 52 motors, and 31¾ in. wheels. Two sizes of cups were used, 3 oz. on the motor suspension and pinion end of the armature bearings, and 1 oz. cups on the solid bush end armatures. These were fitted in January, and up to the time the record was taken the car had run 2,719 miles. The amount of grease used during that time has been 8½ ozs., or 3·12 ozs. per 1,000 miles. The price of the grease used in the test was 6d. per lb., so that the test shows the cost of grease lubrication per 1,000 miles amounts to the very low figure of 1·7d., as against 11·25d. per 1,000 miles for oil lubrication with the "Mœlline" system, which is used on all the Ayr



Tramway Truck Fitted with Menno Grease Cup.

Corporation's cars at the present time. It was found during the test that it was sufficient simply to give two complete turns to the cups at the end of every 400 miles run. This gave the best results and ample lubrication.

As a further proof that the lubrication is effective, the current consumption during this test works out at ·79 unit per car-mile, a very low figure indeed. The bearings have been examined from time to time, and they have been found in excellent condition. Mr. Grant is anxious, however, to give a further trial during the warm weather, and for this purpose is having other cars fitted.

In concluding his report Mr. Grant says: "I would just add that I have hitherto been very much opposed to the principle of grease lubrication on tramways, and this is the first occasion I have resorted to such a form. From the figures given above I feel sure that the change is justified. I shall, however, continue to watch this test very keenly and with increased interest."

Tramway Exhibition Cancelled.—Mr. A. R. Fearnley, president of the Municipal Tramways Association, informs us that it has now been decided not to hold an exhibition in connection with the Municipal Tramways Conference in Sheffield in September. When the preliminary programme was drawn up it was found that the visitors would not have sufficient spare time, owing to the special demands which, it is expected, will be made upon their time while in Sheffield, to justify an exhibition. The president has therefore been reluctantly compelled to abandon the idea of holding an exhibition this year.

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LONDON, JUNE 5, 1913.

To Avert Chaos in London.

If the London County Council and the suburban tramway authorities are in earnest in the desire for the inauguration of a Traffic Board for the Metropolitan area, and the consequent protection of the interests of the ratepayers from unfair competition, they must lose no time in setting on foot the agitation that will be required to impress the Government with a sense of their earnestness. Encouragement in this course will be found in the example set last year by the delegates who form the Standing Joint Committee of the Borough Councils, in formulating demands upon the Government for a share of the petrol duty in order to repair roads devastated by motor traffic. The insistency of the demand caused the Road Board to pause in their labour of accumulating a reserve fund of over a million sterling, which is being put by with a view to enabling the Government to gain prestige for meeting, by means of road-making operations, the distress which is expected to raise its head in the first winter after the abatement of the trade boom. Another advantage which accrued from the agitation was that the ratepayers learnt that, although they have to meet the bills for road repairs, their representatives on the Councils have no power to prescribe the roads which motor omnibuses should use. The same lesson will be conveyed by the requests which the County Council have forwarded to the local authorities, from the City Corporation downwards, for reductions in the amount of rates paid upon the tramway tracks owing to the effects of competition. Unfortunately, the lesson will not be completely brought home to the individual householder until he is made responsible for the payment of the rates, instead of paying a fixed sum to the landlord, to include both rent and rates. Another truth that a reform movement fostered by tramway undertakings should proclaim is that the tramway authorities are fettered by an antiquated system of Home Office government, which has brought an area of 15 miles from Westminster under the jurisdiction of the police for the licensing of its public carriages; that therein no limit can be placed upon the number of vehicles licensed; and that nobody possesses the power to prescribe the routes. As an outcome of the latter shortcoming it has been fully proved in the evidence given before the House of Commons Committee that the overcrowding of the main thoroughfares with two kinds of public vehicle is responsible for the alarming number of fatalities, and that these are highest in streets where the motor conveyance has complete sway. Attention must also be drawn to the fact that police inspectors are set to scrutinise tramways and tramcars, and to oppose new schemes in Parliament, and that their fastidiousness is shown by requiring a car to be painted when its coat is quite fitted for another year or two of service. For the second time in the history of their tramways the ratepayers of Croydon are being asked to consider their pockets by giving support only to the Corporation undertaking. To render the appeal effective the authority should face the expenditure which is necessary in order to secure through running over the London system. It is difficult to force such an appeal home to people, mostly non-ratepayers, who prefer to pay a higher fare for a through ride on an omnibus, than to face the inconvenience and danger from traffic in changing cars at the London boundary. The popularity of through running has been amply demonstrated in the cases of the municipal tramways in the north-eastern area of the

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metropolis; and a later instance is that of the Metropolitan Company's system in the north and north-west. It is disheartening to observe the ignorance regarding public passenger traffic in London and the provinces which dominates what are termed the "great" London newspapers. Their writers need to be informed that every provincial authority has control over its own roads, and that motor omnibuses have been run unprofitably for half a dozen years on a number of routes in towns where there are no tramways. A little more information would prevent the absurd newspaper head-lines, such as the following, which recently embellished the columns of a widely-read journal: "Acquisition of Omnibuses by the Sheffield and Birmingham Corporations; Motor *v.* Tram. Competition Extends to the Provinces; Birmingham's Lead." Instead of the Birmingham Council leading, they are the last of nearly a dozen authorities to run omnibuses on routes where tramways are non-existent, with a view to developing the traffic sufficiently to warrant the laying of an electric tramway.

Tramway Prospects in South America.

During the past month public attention has been directed afresh to devolopments in South America. A generation ago this great continent was in a very backward condition, but for a good many years it has been going forward with rapid strides. Even the tropical regions in the north are sharing in the progress. The facts are, of course, of special interest to this country, owing to the very large amount of British capital which is invested in South America. A great proportion of this capital has been sunk in railways, and much of the expenditure has already proved very remunerative. The public have not recently been asked to subscribe very much for South American tramways, but the fact remains that these undertakings have, in recent years, developed enormously, both in mileage and in traffic. Some of the greatest and most prosperous tramway undertakings in the world are in South American cities. The Governments in that part of the world do not suspect and restrict every movement of tramway enterprise, but allow fair scope for providing means of local transportation for great and growing communities. Recent directors' reports show the continued prosperity and growth of these undertakings, and many of them afford good prospects for investors. Tramway companies in South America are great and important institutions which, having been granted valuable concessions, accept and fulfil correspondingly important responsibilities. In doing so they are not worried by irresponsible and promiscuous competitors, and, indeed, their position is largely like that of important railway companies. They do not appear to be subjected to competition by motor omnibuses; in fact, it is not likely that in new countries, such as those of South America, any great stretches of roads except in the centres of cities are to be found of such a nature as to allow of omnibuses being run with comfort to the passengers and profit to the owners. Taking these tramway companies as a whole, there is little doubt that they may look forward to a prosperous career.

Petrol-Electric Tramcars.

As tramway systems in South American cities, and indeed in cities in many of the British Dominions, extend more and more into the suburbs and tend to become interurban, there would appear to be a growing opportunity for the use of self-propelled cars. In very many cases where road surfaces are bad it would not be economical or comfortable to attempt to carry passengers beyond the tramway termini by such means as omnibuses or trackless trolley cars. Rails are required. This, in fact, was the origin of street railways in the United States half a century ago. For suburban and rural extensions where traffic is likely to be small for some years, it will probably be found a good plan to use petrol or petrol-electric tramcars. The cost of electrically equipping the routes and of providing long transmission cables from the central power-station would thus be avoided, and such avoidance is of importance where the traffic is small. In India we already have an example of a highly successful tramway at Karachi where the cars are driven by petrol engines, and the working expenses are very low. At Morecambe in England petrol cars are doing well on a short tramway. Then we have the petrol-electric cars—the first of their kind—described in the present issue, which are to be used on routes of comparatively light traffic in London. On these routes the traffic would not warrant the expense of the conduit electric

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system, and the Borough Councils concerned will not consent to the use of the overhead wire system. Hence the tramways in question, hitherto worked by horses, are to be operated by petrol-electric cars. This system possesses some desirable features, and the London County Council are to be congratulated on their enterprise in the matter. There are considerable possibilities for such a system in this country, but even greater possibilities abroad in regions where road surfaces are such as to make a tramway of some sort a necessity if reasonable comfort, reasonable speed, and economy of working are to be secured.

Gears and Gear Lubrication.

The subject of gears and their efficient lubrication is of perennial interest, and we need make no excuse for discussing the matter again. We have several times advocated the use of motors with twin gears, a pinion on the commutator end of the armature shaft as well as one in the present position; but, although motors have been made in this way, the idea has received but little practical application. Of course, the first cost of these gears would be higher than that of the single-gear drive, but the resultant economies in gear wear would very probably go far to counterbalance the initial higher price and, at the same time, an undoubtedly more satisfactory drive would be obtained. Put briefly, the performances of gears on electric motor cars may be summarised as follows: The gear and pinion may wear down evenly to a thickness which is recognised as the minimum for safety. This, as tramway engineers know to their cost, is an all too infrequent occurrence. The gear and pinion may wear unevenly. This is due to the unbalanced thrust of the pinion on the gear causing the armature bearing at the pinion end to wear badly, and so force the pinion to do all the driving on the inside edge and consequently wear the teeth to a taper. This occurs very frequently, and can only be met by keeping the armature bearings in good order. A great deal of trouble in this direction can be obviated by proper attention to these bearings. It is too often the case that the work of re-babitting bearings is left to a workman who has little knowledge of what he is doing, who melts out the old white metal from the shell at a high temperature, and burns out most of the tin. The result is that armature bearings are lined with what is little more than lead. A thin lining of good quality white metal will give a very long life in armature bearings. But, to return to the performances of gears, fractures of teeth and of the spokes and rims of gear wheels are too common. The need for something better than plain untreated Siemens-Martin steel for gears is already becoming generally recognised among tramway engineers, and it becomes a question which local conditions must decide how far tramway officials may go in using treated gears or gears made of special steels. Various case-hardened gears and pinions have been tried with varying results, but it must always be borne in mind that treated gears of this description are inclined to be brittle. The tensile strength of the steel is increased at the expense of elongation, and the result is that it is preferable to use a stub tooth in place of the cycloidal tooth which undoubtedly gives sweeter running. Very good results have been obtained in electric railway practice by the use of nickel steel gears, but these are very expensive, and it is doubtful if the extra cost is warranted in the case of tramways. The tendency among tramway engineers is undoubtedly to go in for somewhat more expensive gears than heretofore on account of greater life and less risk of failure due to broken teeth jamming the gears and causing the scrapping of the running wheels through flats as well as the loss of the gear and pinion. The use of solid-forged gears is coming more into favour, as it has been found very difficult to ensure a really satisfactory cast split wheel owing to the drawing action of the large amount of metal in the boss when the casting is cooling. With regard to the very vexed question of gear lubrication, many attempts have been made to solve the problem. We are inclined to think that the method of using sawdust saturated in cheap black oil is probably as satisfactory as any other. So long as the sawdust maintains its form, before it is ground into an impalpable dust, its resiliency goes a long way to quiet noisy gears. It is a question of maintenance as to how often this sawdust and oil require to be changed. The substitution of cork dust for sawdust is an improvement, but there is the disadvantage that the cork dust

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grinds up into powder quicker than the sawdust. Various forms of gear-shield, which have been found eminently suitable for the lubrication and the quieting of stationary gears, have been tried on tramways, but we have not heard of a case where its use has been continued. The drawback is that the nature of gear-shield is destroyed by oil, and it is very difficult indeed to make the armature bearings oil-tight. With some of the newer types of traction motors fitted with oil-ring lubrication, it may be possible to get over this trouble, and it would be very well worth while to try the experiment if it has not been tried. There is no doubt that something better than plain gear grease is wanted, as noise complaints are very frequent and, from our observations, are very often justified.

LIABILITY FOR ROAD MAINTENANCE.

A Changing Situation.

The time has fully arrived when everyone concerned in road and rail transportation of passengers and goods ought to take stock of the whole question of liability for road maintenance. The subject in its broadest aspect is a very large one, and concerns road authorities and the general public as well as those who operate mechanically-propelled vehicles. Here we propose to touch on a few aspects which more immediately concern users of the road for public conveyances.

The situation, which had remained practically unchanged for years, began to alter with the advent of the private motor car. It changed further when heavy motor goods lorries and vans and motor omnibuses appeared on the scene. It is now undergoing a further transformation by the development of the railless trolley system. The net result at the moment is chaos. Various arrangements have from time to time been brought into force to meet particular cases; there has been no guiding principle; inconsistence and unfairness are to be found everywhere; the action of some Parliamentary Committees regarding the railless trolley system is making the confusion worse. Let us review some of the main facts.

Road Tolls and Tramways.

The system of turnpike roads and toll-bars was in the middle of last century almost universal in the United Kingdom, and the principle involved was also applied by special tolls on bridges. There was something to be said for the idea that those who used the roads should pay for their maintenance. In times of smaller population and less road traffic than exist to-day, the arrangement could also be practically carried out with little inconvenience. But a persistent public agitation arose for the abolition of tolls, and it was hard to resist the argument that public roads used by all should be free of tolls, and that the cost of maintenance should come out of the rates. So tolls on roads and public bridges were gradually abolished, and rating and maintenance put fully into the hands of the local authorities, the institution of county councils being a part of the process. It was not, however, till 1889 that the toll system was finally superseded. By the majority of the public it died unwept, unhonoured, and unsung. But it can hardly be doubted that the accepted existence for generations of the toll system aided to the imposition by the Tramways Act of 1870 of a special burden of liability for road maintenance on the owners of tramways. The obligation to maintain the road surface between the rails, between the tracks (where double track is used), and for 18 in. outside the outside rails was no doubt regarded as a special toll for the use of the road, and also for the exclusive use of the rails with vehicles having flanged wheels. Moreover, as in those days horse traction was almost universal for tramway purposes, there was something to be said for a special charge because of the fact that the horses drawing the cars always followed invariable lines on the road surface, instead of being able to deviate laterally all over the road, and thus caused special wear of the surface along those lines.

This provision of the Tramways Act has received several rude shocks owing to modern developments, but it still stands. The first shock was the general adoption of electric traction for tramways. After this it could no longer be maintained that the tramway traffic produced any road wear whatever. Yet the tramways have to go on paying for the maintenamce of road surfaces which are worn out by every other form of traffic. And this burden ever becomes greater and more unjust as general swift and heavy automobile traffic increases. The motor lorry and the motor omnibus, using the roads free, was another shock to the principle of tramways paying for road maintenance. Still another call for modification of the law arises from the increased working expenses of tramways owing to dearer fuel and materials and higher wages of employees. Moreover, the large sums paid in rates on tramway tracks help to maintain the roads for general traffic, so that tramways are hit in two directions for road maintenance while all other traffic goes free.

Automobile Traffic.

The coming of the private motor car did not make much difference to maintenance of solidly paved city streets, but suburban and rural roads soon began to suffer. The macadam—often of a sort which would have made Macadam himself groan—frequently could not withstand for any length of time either high-speed traffic or extra heavy loads. In dry weather the dust nuisance produced by fast cars became intolerable. In wet weather the pneumatic tyres sucked lumps out of the road surface and left it in holes. As the pleasure cars multiplied they were followed by motor lorries and steam tractors which produced a crushing influence on the road surface as distinguished from the tearing-up effect of the faster and lighter cars. Road authorities were faced with the cost of practically reconstructing their main roads, and of providing, as far as possible, a dustless surface. To a great extent this has now been done, and at enormous cost to the rates. It will be observed that in the main the people who cause this excessive wear to the rural roads, are not the people who pay the road rates. Railway companies in particular have been unjustly hit. In many districts they are by far the largest ratepayers, and they have to pay for the maintenance of roads which are being worn out by their competitors both for passenger and goods traffic. The only real impost on the automobile is the petrol tax, and if it uses steam or paraffin or benzol it escapes even that. The proceeds of the tax along with the duties on pleasure cars go to the Road Board who, instead of paying out practically all the money to the local authorities for road maintenance, accumulate most of it into a great reserve fund which apparently may be used for new roads. Even if the whole of these

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taxes went to road maintenance, it is hardly likely that the road rates would ever sink to their old level.

The Motor Omnibus.

To some extent the case of the motor omnibus is covered by the considerations relating to automobile traffic in general, because the omnibus does run on rural roads in many districts. But the special case of London, the home of the omnibus, must be mentioned. In the days of the horse-drawn 'bus, nobody—or very few people—thought that those vehicles should pay for the use of the streets. They were light and slow, and any damage to road surface was caused by the horses' hoofs just as in the case of any other horse-drawn vehicles. Then the motor vehicle gradually supplanted the horse 'bus, and the earth trembled and the air quivered from the passage of the motor 'buses. Even solidly-paved streets suffered, and the suburban roads were torn to pieces. No local authority in London had any control whatever, and all that the Metropolitan Police could do was to suppress excessively noisy vehicles and to reduce the maximum weight from 5 tons to 3½ tons. So matters have in time considerably improved, but there is no power of regulation either as to the routes to be followed or as to the number of vehicles to be used. The fact that a large number of the omnibuses are run in useless and wasteful competition with tramways is outside the scope of the present article. What is germane is this, that about 3,000 motor omnibuses carrying some 450 million passengers per annum cannot run something like 50 million 'bus-miles in a year over metropolitan streets and roads without causing a deal of wear to the road surface. It is, of course, true that the damage is lessened by the rubber tyres. But in the paved streets the crushing action of a load averaging, say, five tons including passengers remains, while on the suburban macadam roads the local authorities have been involved in huge expense for maintenance and reconstruction in wood paving. Furthermore, although such a large proportion of petrol tax accrues from London, grants from the Road Board for metropolitan roads until recently were non-existent.

In few towns outside of London is the question of street wear by motor 'buses acute, nor is it likely to become so, especially in towns where there are tramways. The local authorities—unlike the case of London—have the licensing in their own hands, and can withhold licences, or if they grant them, can limit the numbers and prescribe the routes to be followed.

The Trackless Trolley.

The question whether a trackless trolley undertaking should be called on to contribute to the maintenance of the roads over which the cars run has been repeatedly raised in Parliament, and it is not definitely settled yet. The earlier schemes to be sanctioned were promoted by municipalities, and where it was proposed to run outside the municipal boundaries the county authorities made the claim that they should have a contribution from the promoters for road maintenance. Parliamentary Committees refused the claim, as they did also in the case of municipal motor omnibus schemes. There was, of course, a better *prima facie* case for the demand in the case of the railless trolley, because the cars, like tramcars, are confined to certain routes, while motor omnibuses are not. When the Government introduced their Light Railways Bill last year it contained a clause providing for trackless trolley schemes being authorised by Light Railway Order—a cheaper and simpler procedure than that of private bill. As may be remembered, the rural local authorities brought pressure to bear on members of Parliament, with the result that in the committee stage the clause was altered so as to provide for trackless trolley promoters contributing to road maintenance. The Government were opposed to this and they dropped the clause altogether.

This year a number of contests are going on before Parliamentary Committees on the same question. It has been raised on railless traction bills promoted both by local authorities and by companies. In general it may be said that the Committees have refused to impose against the will of the promoters any fixed contribution for road maintenance, as they think that there should be general legislation on the subject. In the case of the Chesterfield Corporation Bill, however, a Committee inserted a clause making the promoters liable for any extra expense of the County Council for road maintenance attributable to the trackless cars, such expense to be determined if necessary by arbitration. This will cause great trouble and expense to determine what in this case must be a very small sum, the distance to be equipped on the county roads being short. In other instances, as for example the railless traction bill promoted by the Rhondda Tramways Company, an agreement was come to between the parties. The Rhondda Company agreed to pay to the local authority one-third of the extra annual road maintenance cost incurred in consequence of the trolley vehicle traffic, such proportion not to exceed ⅜d. per mile run. This has the merit of definiteness, but the maximum is a heavy charge on vehicles running in districts where the receipts per mile are small. Yet it is just for such sparsely-populated districts that the trackless trolley is designed. The case, it will be observed, is different from that of the motor omnibus, which not only wears the roads more, but must run at such intervals as will secure a good load of passengers to meet its higher working expenses.

The Whole Position.

Here then, in brief, is the whole incoherent position. Tramways are taxed twice over for road maintenance; they have to maintain the tramway area of the streets, and they have to pay heavy rates. All automobile vehicles go completely free except for the petrol tax, a comparatively small impost, most of which is not going to road maintenance at all. The beginning of a burden which may become general is being put on the railless trolley system. This burden, if it were not for the cost of ascertaining its amount, might not in many cases be prohibitive, but it is sure to be restrictive. The question is what is to be the outcome. The imposts on tramways and on the railless trolley savour of the days of tolls. Is the country to return still more to that old principle by taxing automobiles specifically for road maintenance? If so, can it avoid taxing every sort of vehicle that uses the roads? A wheel tax has been proposed before now. We do not here propose to put forward any specific remedy for dealing with the problem. But the fact is plain and insistent that the present unfair arrangement—it is not a system—must be abolished. Either tramways and the railless trolley must be relieved, or other classes of vehicles must contribute. Tramways in particular need relief from the double burden upon them.

Apart from any ideal specific, it is permissible to speculate as to the possible trend of future legislation. There cannot be a doubt that the tendency at present is to spread the area of taxation. The taxes on private cars and on petrol, such as they are, are recent inventions. The liability of the railless trolley for contributing to road maintenance seems likely to be widely established. The next step seems to be a charge per mile run on motor omnibuses and other heavy motor vehicles for

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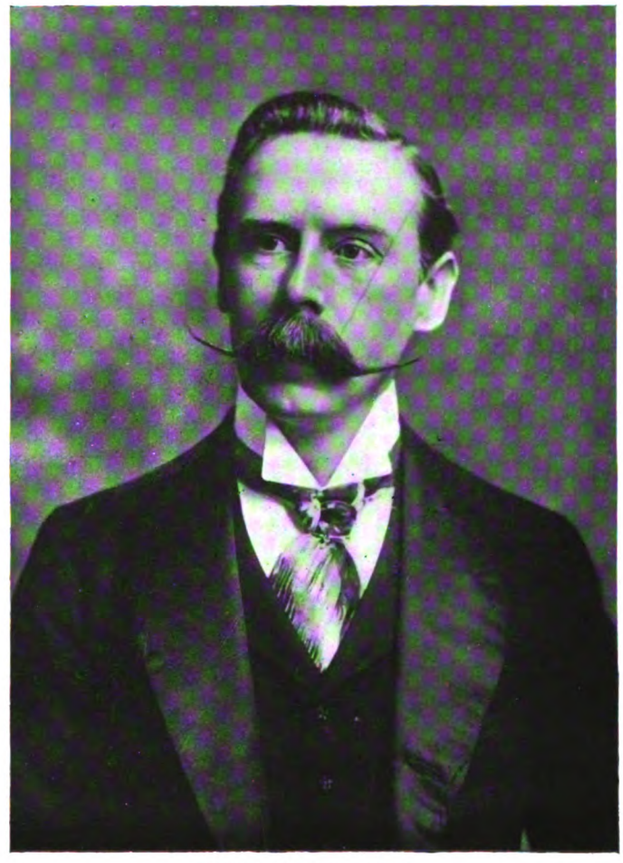
upkeep of the roads. Whether that method will ever be extended further it is impossible to say. Legislation will not proceed *per saltum*; there is no likelihood of a great jump for the purpose of securing an ideal system fair to all. But in the various steps which may be taken we repeat that it is the tramway that is entitled to relief. The want of that relief is one of the causes which has prevented a much greater extension of tramways throughout the United Kingdom.

JAMES W. COURTENAY.

It is with deep regret that we record the death of Mr. James Watts Courtenay, managing director of THE TRAMWAY AND RAILWAY WORLD, which occurred very suddenly at his residence, Wymondley House, Stevenage, Herts., on Sunday, June 1. Mr. Courtenay had for several years suffered from heart trouble; but for some time recently he had been in better health, and his sudden death has come as a shock to the wide circle of friends who mourn their loss. On Friday last he returned to London from Brighton, where he had been for a brief rest, and after a busy day proceeded to his home at Wymondley. On Saturday and Sunday morning he appeared to be as well as usual, but in the afternoon, after writing a letter, he passed suddenly and peacefully away.



James W. Courtenay.

Mr. Courtenay was born at Newcastle in 1857, and at the age of 23 began business in the same city as a tramway advertising contractor. By his energy and acumen the business was rapidly developed, and he established branches in various cities throughout the country. In 1892 he was associated with others in the establishment of THE TRAMWAY AND RAILWAY WORLD, and in the following year he acquired a controlling interest in the paper and became its managing director. In 1899 he transferred his head-quarters to London, and took up his residence at Wymondley House, Stevenage. The following years—which were marked by the rapid development of electric traction—were a period of great activity. His business was extended in various directions. In India and South Africa the advertising house of Jas. W. Courtenay became well known, and in this country the principal tramway undertakings placed their advertising arrangements in his hands.

Many readers, both at home and abroad, will recall the interesting and important Tramway and Light Railway Exhibitions of 1900, 1902, and 1905, which were largely due to Mr. Courtenay's enterprise and genius for organisation. At his suggestion the Tramways and Light Railways Association, of whose Council he was an active member, invited the "Union Internationale de Tramways et de Chemins de fer d'Intérêt Local" to hold their biennial congress for the first time in London in 1902. The then president of the International Union, the present Baron Janssen, took an opportunity at one of the meetings to express their appreciation to Mr. Courtenay in particular for the arrangements which rendered their international gathering in London an agreeable and memorable occasion. The thanks both of the Tramways and Light Railways Association and the Municipal Tramways Association have on several occasions borne record to the useful services which Mr. Courtenay in various ways rendered to the tramway industry.

Possessed of a forceful but genial personality, Mr. Courtenay's interests were wide and varied. He had great taste and discrimination in matters of art, and his home was characteristic of the man. A careful and an acute observer, during his many journeys abroad he had acquired a singularly accurate knowledge of the possibilities now open to British traders. He was an Imperialist who years ago foresaw the progress now partially realised in South Africa, and he looked forward to an immense development of British interests in that continent and elsewhere.

To his business associates and employees Mr. Courtenay was in a very real sense a personal friend. Many were his acts of unostentatious sympathy which were known only to the recipients. Considerate and generous to all with whom he came in close contact, he endeared himself to a wide circle of friends and awakened admiration in no ordinary degree. Of serene and high courage, he bore himself with unconscious heroism through a long struggle with failing health. Assiduous, uncomplaining, he was at times intensely conscious of failing vitality, but refused to divest himself of duties or responsibilities, and preferred to approach the end in the harness of a useful life.

THE NEED FOR A LONDON TRAFFIC BOARD.

Sir Edward White, chairman of the Highways Committee of the London County Council, in giving evidence before the Select Committee of the House of Commons on London Traffic Accidents, urged the appointment of a traffic board. Sir Edward stated that at present tramways were subject to a good deal of supervision on the part of the Board of Trade, the Home Office, and the Local Government Board, but if a traffic board were established the work now divided in this way might be concentrated in it. The new authority should have power to regulate and control every form of transit, including the metropolitan traffic of the great railways, and omnibus routes. The board might be associated with a Government department, so that it could be represented in Parliament by a minister.

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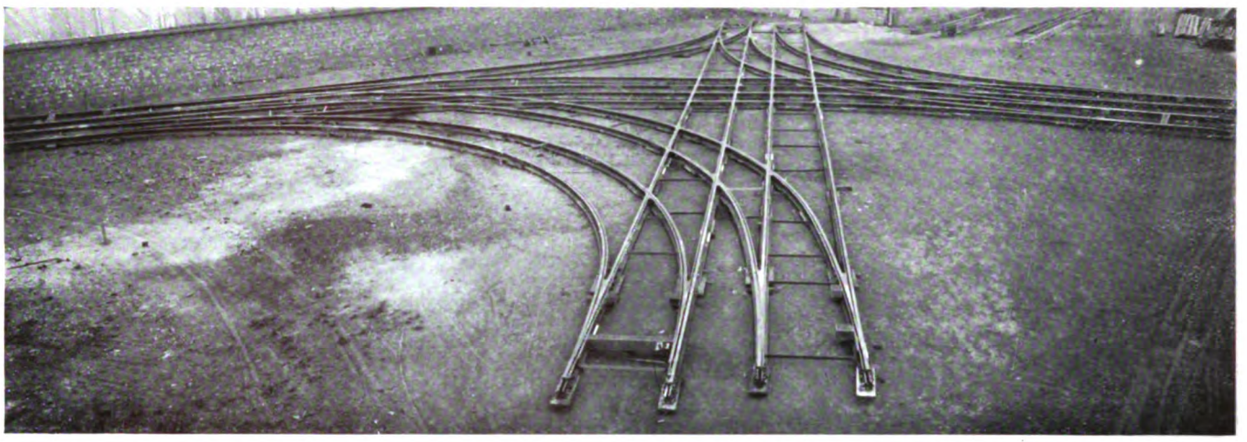
"TITAN" TRACKWORK.

At the Victoria Hotel, Nottingham, on May 29, a large company of guests were entertained to luncheon by the Titan Trackwork Company, Limited, prior to visiting their works in the town. The firms associated with the company are Samuel Osborn and Company, Limited, Clyde Steel Works, Sheffield, and the Railway and General Engineering Company, Limited, Nottingham. The Titan Company have also works in Sheffield. The visitors were shown the applications of Osborn's Titan manganese toughened cast steel, as supplied by the Sheffield works, after going over the setting out floor for templates, Mond gas plant, two foundries, two machine shops, and a forge. There were of Titan manganese steel three double junctions and crossings for Newcastle-on-Tyne Corporation Tramways; steel gullies, manholes, and tramway drain boxes, etc., for Durban, Bristol, the Notts. and Derby Light Railway Company, the Leeds, Nottingham, and Sheffield Corporations, and the Walthamstow Urban District Council.

The special lay-out for the Bell Junction at Walthamstow was on the ground, and is shown in our illustration. The whole lay-out is to the specification and design of Mr. G. W. Holmes, engineer to the Council, and was made to the order of Messrs. G. Percy Trentham, Limited, Winchester House, Victoria Square, Birmingham. This lay-out is most interesting, and was closely inspected by the visitors. It will be laid down eventually in the busy centre of the Walthamstow Urban District Council tramway system at the junction of the Chingford to London main road with Forest Road. In addition to the lay-out shown in the illustration, cross-overs abut on each of the four ends of the junction, the overall measurement of the complete lay-out being approximately 278 ft. by 265 ft. The whole of the special work was constructed by the company, all the points, crossings, and most of the rails being manufactured in "Titan" manganese cast steel, the inside curves having a special manganese guard attached. Sole plates, 2 ft. 6 in. long by 1 in. thick, are fitted under each joint: the total weight of the lay-out, excluding the cross-overs, being 60 tons, of which nearly 40 tons are castings in Osborn's "Titan" manganese steel. A duplicate tongue is fitted to every point, and all points have been fitted with the Titan three-way mechanism, Crosta and Hill's patent, and Titan patent heel adjusters.



Lay-out for Bell Junction, Walthamstow, as Completed by the Titan Trackwork Company.

Special Work under Construction by Titan Trackwork Company at their Nottingham Works.

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PERSONAL.

Mr. E. Garcke has been elected a member of the Royal Institution.

Mr. T. J. Kendrew, deputy manager of the Southport Corporation Tramways, was on May 7 appointed manager.

Mr. J. R. Meyers, station superintendent at Ilford electricity works, has been granted an increase in salary.

Alderman J. H. Aston, chairman of Huddersfield Corporation Tramways, has been appointed a justice of the peace.

Mr. J. F. Jones, joint manager of the Madras electric tramways, has arrived in London on six months' leave of absence.

Mr. J. H. Cardew, electrical engineer of the Oudh and Rohilkund Railway, has been appointed electrical engineer of the North Western Railway of India.

The Right Hon. Charles B. Stuart-Wortley, K.C., M.P., has been appointed chairman of the board of the London and Suburban Traction Company.

Mr. E. H. Cockshott, formerly chief engineer of the London United Tramways Company, has been appointed assistant engineer to the London Underground Electric Railways.

Sir Thomas Pilkington, owing to the pressure of business in connection with his estate and other matters, has retired from the board of the Potteries Electric Traction Company.

Mr. H. H. Couzens, late electrical engineer to Hampstead and West Ham Councils, has been appointed general manager of the hydro-electric undertaking of the Toronto Electric Commissioners.

The Hon. Arthur Stanley, M.P., has been elected president of a committee formed at Liverpool to establish a flying corps to be associated with the City and the Royal Flying Corps.

Mr. E. A. Smith, chief clerk of Liverpool Corporation Tramways, has been granted an increase of salary from £250 to £275 per annum, rising by annual increments of £25 to £325 per annum.

Mr. A. Wilkinson, who for the past five years has been works superintendent of the tramway repair works of the London County Council, has been appointed works manager to the Anti-Attrition Metal Company, Limited.

Mr. G. F. Taylor, who since 1901 had acted as assistant to Mr. Dacre Helme, electrical engineer and tramways manager to Nelson Council, has been appointed to fill the vacancy created by the lamented death of Mr. Helme.

Mr. I. Bulfin, general manager of the Bournemouth Tramways, has received the congratulations of the Tramways Committee and of the Town Council upon the satisfactory character of his report for the year ended March 31.

Mr. Pakenham W. Beatty has resigned the post of manager of the River Plate Electricity Company and the Elétrica del Norte (S.A.), of Tucuman, and has accepted the position of chief engineer to the Lacroze Tramway Company, of Buenos Ayres.

Mr. Robert Maule has announced his intention of retiring from the directorate of the Edinburgh and District Tramway Company, after serving for over 10 years. On June 2 his name appeared in the list of new knights created in honour of the King's birthday.

Mr. G. P. Shallcross has been selected by the Birkenhead Electricity Committee for appointment by the Town Council as electrical engineer at a salary of £400. Mr. Shallcross has for some years held the position of chief assistant electrical engineer at Birkenhead.

Mr. H. T. Wakelam, engineer to the Middlesex County Council, represented the Institution of Mechanical and Civil Engineers at a conference held in May on the method of determining the conductivity of conductor rails. Mr. A. L. C. Fell represented the London County Council.

Mr. A. J. Anderson, who has represented Messrs. John Baker and Company (Rotherham), Limited, for many years, has resigned his position, and is leaving the firm at the end of August. He will subsequently take up another position, particulars of which will be announced later.

Mr. J. M. McElroy, general manager of the Manchester Corporation Tramways, and Mr. H. Mattinson, permanent way engineer, Manchester Corporation Tramways, sailed on May 17 on a visit to the United States and Canada, where they propose to inspect tramways and transportation methods in various cities.

Mr. C. Furness, general manager of the Blackpool Corporation Tramways, was congratulated by Alderman Brodie, chairman of the Tramways and Electricty Committee, at a meeting of the Council on May 6, upon the most successful year the department had had. The tramway profits, he said, amounted to £18,330, an increase of £8,000.

Mr. G. Wilkinson, a York tramway employee, who recently was severely burned in endeavouring to save the life of a child whose clothes had caught alight, has been presented with a sum of money locally subscribed. Since then the amount has been augmented by the sum of £3 10s. given by the 2nd Battalion Yorkshire Regiment, in which he formerly served.

Mr. H. B. Harris, who recently resigned from the post of engineer to Croydon Corporation Tramways, has been presented with a gold hunter watch and a jewelled and gold stud from the staff and employees. Councillor Denning, chairman of the Tramways Committee, in handing the gifts to Mr. Harris, said that the recipient was connected with the undertaking before the electrification, and had done the best he could for the tramways during the whole of that period.

Mr. H. F. Street, electrical engineer and manager of Southampton tramways, has written to the Electricity and Tramways Committee, asking to be allowed to give up his present work for the tramways department at the end of September next, as owing to the enormous increase in the size of the two departments the strain of working very late regularly was becoming too great for him. The Council have agreed to the proposal, and have also decided that the salary of Mr. Street shall remain at £600 a year.

Mr. J. Mordy Lambe, town electrical engineer and tramways manager of East London, South Africa, is coming to England in June on a combined business and pleasure trip, and is a delegate to the Imperial Motor Transport Conference to be held in London in July. Mr. Lambe is particularly interested in trackless trolley and motor 'buses, one of which methods of transport the East London Town Council contemplate adopting. His address will be: c/o Wm. Dunn and Company, Broad Street Avenue, London, E.C.

Sir John Courtis, chairman of the Cardiff Tramways Committee, who last year discharged the duties of Lord Mayor, was entertained by 150 friends and colleagues on May 8 at a complimentary banquet in recognition of the distinction with which he filled the chief office in the city. Reference was made by the speakers to the signal mark of knighthood conferred on Sir John when the King visited Cardiff last year. In reply, Sir John Courtis said he was proud of the distinction, not only as an individual, but as representing the city.

Mr. Cyril Clarke, who is recommended by Birkenhead Tramways Committee for the position of manager, has been connected with the department since the inception of electric tramways in the borough in 1901. He acted as assistant to Mr. A. R. Fearnley in the initial organisation, and during the interim between Mr. Fearnley leaving and and the appointment of Mr. Wyld, he had control of the traffic department. He has also acted as principal assistant in the tramways department during Mr. Wyld's term of office as manager. Mr. Clarke received his early training in the firm of G. F. Milnes and Company, Limited, tramcar builders.

Mr. Alfred S. Giles, general manager of the Lisbon Tramways Company, and Mr. Da Souza, the assistant manager, and all those of the staff who remained loyal to the company during the twenty-seven days' strike of the employees, were accorded a vote of thanks at the company's general meeting on May 14. Mr. Breitmeyer, the chairman, said the management passed through a trying and critical time. Mr. Giles was faced with a clear issue—either to submit to employees on an important question of discipline or to stand firm. The management, with the full concurrence of the London board, refused to yield to the unreasonable demands of the men, and, as a result of this firm attitude, the men returned to work.

Mr. A. A. Day has resigned his position as tramways manager and electrical engineer to Bolton Corporation. During the past nine months he has been incapacitated by illness, and Mrs. Day on May 27 wrote to the Tramways Committee that she felt in honour bound to ask them to accept his resignation. She also expressed deep gratitude and thanks for the generous treatment of the committee and the Council. It was resolved that the committee with much regret accept the resignation of Mr. Day, such resignation to take effect from June 30 next, and hereby tender to Mr. Day their expression of appreciation of the valuable services rendered by him to the borough, with sincere regret that continued ill-health has necessitated his resignation. A sub-committee was appointed to confer with the Electricity Committee as to the best way for filling the office.

Glasgow Tramway Officers' Salaries.—The City Council has voted the following increases in salary: Mr. L. Mackinnon, traffic superintendent, from £600 to £625; Mr. J. Ferguson, chief engineer, from £600 to £625; Mr. E. T. Goslin, electrical engineer, from £550 to £575; Mr. J. N. Wilson, secretary and treasurer, from £400 to £425; and £15 to each of the following officials: R. F. Smith, accountant, present salary, £265; J. Crichton, cashier, £240; A. C. Macdougall, purchasing clerk, £265; A. G. Watson, claims superintendent, £265; J. Grierson, civil engineer, £275; G. Masterton, chief draughtsman, £265; and J. Muir, lady superintendent, £215. Mr. L. Mackinnon, the traffic superintendent, entered the service of Glasgow Corporation in 1887, serving in the cleansing department for five years, when Mr. Young, his chief, requisitioned his assistance in the new tramway offices as confidential clerk. In 1894 he became assistant to the traffic manager, Mr. J. B. Hamilton, whose appointment to the management at Leeds opened the way for his selection to the responsible position which he now so ably holds. Mr. Mackinnon takes a deep interest in the welfare of the employees, of whose golf club he is president, and he was the chief founder of the recently-constituted tramway orchestra. He is also president of the Clan Mackinnon Society.

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CONTRACTS AND ORDERS.

E. Bennis and Company, Limited, are supplying four chain-grate stokers for the Glasgow tramways power-station.

Trackless Trolley, Limited, have received on order from Keighley Council for two railless trolley cars, at £1,420.

Glasgow Corporation have decided to hire 1,000 additional punches from the Bell Punch and Printing Company.

Brush Electrical Engineering Company are constructing four tramway cars for the York Corporation Tramways, at £2,960.

York Council have given a contract for the supply of high-tension cable to Callender's Cable and Construction Company at £2,137.

Blackburn Council have awarded a contract to the British Westinghouse Company, Limited, for a turbo-generator for the electricity works.

Coventry Corporation have allotted a contract to the Brush Electrical Engineering Company for the supply of five double-deck tramcars with single trucks.

The Daimler Company, Limited, have been awarded a contract to supply three motor omnibuses to Rotherham tramways department, at £822 per vehicle.

Messrs. Chamberlain and Hookham have received orders for two-rate meters from Ashton-under-Lyne, and for car meters for Lowestoft Corporation Tramways.

Meters for Lowestoft Cars.—On the recommendation of the manager of the tramways, Lowestoft Council have decided to fix meters on the tramcars at a cost of £61 15s.

Ipswich Council have accepted the tender of Cocksedge and Company for constructional steel-work and roofing, at £605, required for an extension of the tramways depôt.

Pearson, Huggins, and Company, Limited, have obtained a contract to supply 1,500 pairs of drivers' and conductors' winter trousers to Liverpool Tramways Committee.

Babcock and Wilcox, Limited, have had a contract for the supply of boiler, superheater, mechanical stoker, and pipe work, at £2,805, recommended for acceptance by the Belfast Tramways and Electricity Committee.

The Peckham Truck Company, of Queen Anne's Chambers, Westminster, have recently received orders for their pendulum trucks from the Newcastle, Doncaster, Coventry (repeat order), Leeds, and Sheffield Corporations.

Coventry Council have placed contracts as subjoined: Track layout at the new car shed with manganese steel rails, Edgar Allen and Company, Limited, £315; erection of car shed, Messrs. Shaw and Nicholas, Coventry, £3,853.

Argentina Railway Electrification.—Siemens Brothers Dynamo Works are supplying the switch gear required for the generating station in course of erection at Buenos Ayres in connection with the electrification of the Western Railway Company.

The Avon India Rubber Company have secured an order in open competition for "Avon" solid band tyres from the General Post Office for motor mail vans, and a contract from the London General Omnibus Company for the same type of tyre.

Leyton Council have adopted the following tenders: Siemens Brothers Dynamo Works, Limited, a spare lighting armature, at £780, and a spare traction generator armature, at £795; General Cable Manufacturing Company, two miles of cable, at £456.

Walsall Council have adopted tenders as subjoined: E. Green and Son, economiser, £623; Callender's Cable Company, laying main, £601; British Westinghouse Company, sub-station equipment, £167 10s., and Johnson and Phillips, sub-station equipment, £16 10s.

Liverpool Council have placed the following contracts for work required by the tramway and electricity departments: British Thomson-Houston Company, two 6,000-kw. turbo-alternators; British Westinghouse Company, three sets of rotary converters and accessories.

Dick, Kerr and Company, Limited, have been allotted tenders as follow: Permanent way material required in connection with the reconstruction and duplication of the tramway track in High Street North, £776; 50 tons of 90-lb. girder tramway rails, £8 15s. per ton; both at East Ham.

Doncaster Council has placed the following contracts in connection with the supply of six new tramcars: United Electric Car Company, Limited, for car bodies provided with top covers; Peckham Truck Company for pendulum trucks; and Dick, Kerr and Company for electrical equipments.

The Anger Manufacturing and Supply Company, Limited, have closed a contract with the Ackley Brake and Supply Company, giving the latter the licence to manufacture and sell the Anger automatic brake adjuster in the United States, Mexico, Central America, Cuba, the West Indies, and the Hawaii Islands.

Wolverhampton Council have given out the following contracts: British Westinghouse Company, four converters, £2,950; Electric Construction Company, Limited, two switchboards for sub-stations, £408 and £209 respectively; Reyrolle and Company, Limited, extra high-tension switch gear, £2,000; Lorain Steel Company, special work, £1,128.

Bradford Council have allotted contracts as subjoined: Taylor Brothers, 50 nickel chrome steel tramcar axles, £4 5s. 9d. each; Ferranti, Limited, switch gear, £215; Bertram Thomas, switch gear, £2,075 5s.; Underfeed Stoker Company, two underfeed stokers for boilers, £738; Babcock and Wilcox, Limited, two chain-grate stokers, £800.

Manchester Tramways Committee have accepted the following tenders: B.I. and Helsby Cables, Limited, tramway rail bonds; F. Smith and Company, Limited, copper trolley wire; British Mannesmann Tube Company, Limited, steel tramway poles; Naylor Brothers, Limited, span wire brackets; Normanton and Son, Limited, roofing at Hyde Road car works.

Ilford Council Tramways.—In our issue of May 8, in the list of tenders adopted by the Ilford Council, it was reported that the tape to be supplied by Messrs. R. W. Blackwell and Company at 11d. per lb. was the "P" and "B" tape. We understand, however, that Messrs. Blackwell and Company's tender was not for "P" and "B" tape, but for tape of another make.

Milnes, Voss, and Company have received a contract to supply two additional top-deck covers to Lancaster Council on terms and conditions similar to those obtaining in the previous contract at the price of £120 per car. Councillor Wilkinson mentioned that this sum was £26 per car more than was paid before, and the reason given by the company was that recent legislation was responsible for the increase.

Sheffield Corporation have allotted contracts as follow: Twenty-five double-deck top covered extended canopy cars, United Electric Car Company, Limited; motors for new cars, British Thomson-Houston Company, Limited, £104 15s. 9d. each; controllers for new cars, British Thomson-Houston Company, Limited, £23 16s. each; 25 double-deck cars with top covers and single trucks, the Brush Electrical Engineering Company, Limited.

Maley's Brakes for Birmingham.—The Electro-Mechanical Brake Company, Limited, have been awarded a contract by Birmingham Corporation for 40 "Maley" electro-mechanical rail brakes of a new design for maximum traction bogie trucks. The order was placed after a test of a trial brake, which gave very gratifying results both when used as a magnetic brake and as a mechanical brake. This is the second large order placed with the company by the Birmingham Corporation.

Germiston Railless Traction Contracts.—Tenders for the installation of a railless trolley car system at Germiston, South Africa, have been accepted as subjoined by the Town Council, the successful tenderers being Johannesburg firms: Hubert Davies and Company, 10 Cedes-Stoll cars, £11,400, overhead fittings, £1,328, and poles, £6,899; Connocks S.A. Motor Garage, tower wagon, £875; Telegraph Manufacturing Company (Colonial), Limited, electric mains, £4,054; S. Sykes and Company, motor converters, £3,272, and spare stator, £450.

Leeds Corporation have accepted the following tenders: British Westinghouse Electric Company, Limited, two 1,500-kw. rotary converters for Crown Point Station, at £5,295 each; Electro-Mechanical Brake Company, Limited, 50 new type section insulators at 35s. each; British Thomson-Houston Company, Limited, three-phase sub-station switch gear, as required, up to a total of 12 sets, at £45 15s. per set; British Electric Transformer Company, Limited, two sets of two to three-phase transformers, at £628 per set; Waygoods, Limited, electric passenger lift.

The Electro-Mechanical Brake Company, Limited, have recently received orders for 2,500 of their "EMB" unbreakable, jointless, and rustless grid type resistances, including orders from the following Corporations: Leeds, Manchester, Oldham, Newcastle, Leicester, Birmingham, Blackpool, London County Council, West Ham, etc., and also from Cammell, Laird, and Company, the Ebbw Vale Iron and Steel Company, Bombay and Baroda Railway Company, Manchester Ship Canal, Wm. Beardmore and Company, Alfred Hickman, Limited, and the Great Western Railway Company.

Glasgow Tramways Committee have placed contracts as appended for the ensuing 12 months: Steel car wheels, John Baker and Company, Limited, and Hadfield's Steel Foundry Company, Limited; steel tyres, Brown Bayley's Steel Works, Limited; steel axles, Glasgow Railway Engineering Company, Limited; V.I.R. cables, Siemens Brothers and Company, Limited, and B.I. and Helsby Cables, Limited; chilled-iron brake blocks, Miller and Company, Limited; fireclay goods, Glenboig Union Fireclay Company, Limited, and Currie and Company, Limited; springs, Geo. Turton, Platts, and Company, Limited, and L. Sterne and Company, Limited; steel (tool, etc.), Ibbotson Brothers and Company, Limited, and L. N. Ledingham and Company; wrought-iron tubes, etc., Stewarts and Lloyds, Limited, and Scottish Tube Company Limited; cotton waste, etc., Wm. Wiseman and Son, R. and W. Cuthbertson, and Jas. Paxton and Company.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls.	Line open (single track). Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Loans Repaid and Sinking Fund.	Depreciation, Renewal and Reserve Funds.	Gross Receipts. Traffic.	Gross Receipts. Other.	Gross Receipts. Total.
Aberdeen ...	* May 31, 1912	Dec., 1899	E.	27	60	350,000	346,075	3,925	346,075	12,471	196,825	149,250	119,621	76,130	1,050	77,180
Accrington ...	† Mar. 31, 1913	Aug., 1907	,,	10	53	169,675	134,670	35,800	134,525	12,619	116,976	17,694	13,200	27,419	403	27,822
Ashton-u-Lyne ..	* Mar. 25, 1912	Aug., 1902	...	8	15	130,070	108,099	21,971	108,099	13,203	83,240	24,859	1,650	21,340	551	21,891
Ayr	* May 15, 1912	Sept., 1901	,,	7	49	128,000	74,405	53,595	82,914	10,892	64,417	16,078	14,028	15,092	660	15,752
Birmingham ...	† Mar. 31, 1913	Jan., 1904	,,	108	32	2,302,001	2,089,194	212,807	1,981,588	18,280	1,874,109	215,084	220,369	574,248	7,328	581,566
Blackburn ...	† Mar. 25, 1913	Mar., 1899	,,	24	63	408,174	342,474	65,700	334,924	13,512	254,600	167,381	1,000	63,440	3,243	66,683
Blackpool ...	* Mar. 31, 1912	June, 1899	,,	21	31	438,028	294,483	143,545	295,984	13,839	294,483	102,855	16,259	64,313	1,027	65,340
Bolton	* Mar. 31, 1912	Dec., 1899	,,	47	17	552,208	548,208	4,000	538,958	11,416	381,750	145,383	45,920	131,155	991	132,146
Bradford ...	* Mar. 31, 1912	July, 1898	,,	(h)101	74	1,269,568	978,063	291,505	965,366	9,471	645,883	355,633	75,120	274,328	15,007	289,335
Brighton	* Mar. 31, 1912	Nov., 1901	,,	17	15	279,070	274,905	4,165	274,905	15,994	229,717	40,174	5,834	52,144	1,884	54,028
Burnley	* Mar. 31, 1912	Dec., 1901	,,	21	5	388,052	278,032	110,020	209,348	9,939	168,989	50,161	47,430	72,454	255	72,709
Burton-on-Trent	† Mar. 31, 1913	Aug., 1903	,,	9	60	108,632	104,562	4,070	106,225	10,895	50,583	53,979	8,966	14,383	1,304	15,687
Bury	† Mar. 31, 1913	June, 1903	,,	21 (b)13	14 21	407,800	280,775	127,025	283,005	13,365	262,135	42,877	(l)24,571	67,370	284	67,654
Chester	* Mar. 25, 1912	April, 1903	,,	6	35	92,991	82,380	10,611	82,934	12,883	71,027	11,490	1,998	12,343	477	12,820
Chesterfield ...	* Mar. 31, 1912	Dec., 1904	,,	5	8	95,000	70,500	24,500	69,575	13,642	60,289	10,211	5,031	11,709	496	12,205
Colchester ...	* Mar. 31, 1912	July, 1904	,,	7	75	70,748	69,555	1,193	69,401	8,740	55,805	14,700	...	10,284	450	10,734
Croydon	* Mar. 31, 1912	June, 1906	,,	18	10	287,689	287,689	Nil	284,847	15,608	232,636	78,027	37,206	92,539	1,891	94,430
Darlington ...	* Mar. 31, 1912	June, 1904	,,	8	71	107,500	76,165	31,335	76,322	8,587	58,431	17,175	4,504	11,491	383	11,874
Darwen	* Mar. 31, 1912	Oct., 1900	,,	7	13	93,400	86,300	7,100	85,748	11,972	60,670	25,718	6,400	14,530	241	14,771
Derby	* Mar. 31, 1912	July, 1904	E. H.	22	5	... ...	... ...	... ...	242,476 ...	10,999 ...	191,798 ...	50,678 ...	(a)4,005 ...	E 46,388 H 407	975 18	47,363 425
Doncaster ...	* Mar 31, 1912	June, 1902	E.	11	62	103,900	94,500	9,400	95,025	8,070	82,400	13,020	27	17,417	252	17,669
Dundee	* May 15, 1912	July, 1900	,,	27	38	...	341,416	...	349,854	12,734	266,161	77,173	60,984	62,016	664	62,680
East Ham ...	* Mar. 31, 1912	June, 1901	,,	14	32	189,524	187,073	2,451	...	191,260		50,374	...	57,342	668	58,010
Exeter	* Mar. 31, 1912	April, 1905	,,	7	0	106,000	86,111	19,889	86,111	12,301	71,325	15,243	4,925	17,290	Nil	17,290
Gloucester ...	* Mar 31, 1912	April, 1904	,,	15	2	191,000	144,243	46,757	147,692	9,846	113,280	14,587	...	15,894	1,108	17,002
Halifax	* Mar. 31, 1912	June, 1898	,,	54	20	450,313	402,735	47,578	403,255	7,433	302,139	95,385	21,561	100,884	1,010	101,894
Ilford	* Mar. 31, 1912	Mar., 1903	,,	11	28	149,633	149,633	Nil	149,136	13,140	114,806	34,827	7,648	27,294	2,272	29,566
Ilkeston	* Mar. 31, 1912	May, 1905	,,	4	24	64,214	47,000	15,074	47,936	11,148	42,600	11,919	350	6,533	156	6,689
Ipswich	† Mar. 31, 1913	Nov., 1903	,,	14	70	116,471	114,300	2,171	114,838	7,720	98,858	16,305	8,180	22,575	829	23,404
Keighley	* Mar. 31, 1912	Oct., 1904	,,	6	9	50,934	46,903	4,031	46,903	7,675	34,465	15,080	1,310	9,588	251	9,839
Kilmarnock ...	* May 15, 1912	Dec., 1904	,,	5	47	65,000	48,246	16,754	52,666	9,426	48,205	6,090	2,749	8,400	237	8,637
Kirkcaldy ...	* May 15, 1912	Feb., 1903	,,	8	65	213,000	92,581	120,419	96,749	11,041	77,885	14,696	3,643	15,584	481	16,065
Lancaster ...	* Mar. 31, 1912	Jan., 1903	,,	4	65	60,000	51,550	8,450	43,412	9,021	39,000	12,371	3,000	5,566	144	5,710
Leith	* May 15, 1912	Aug., 1905	,,	17	73	275,000	235,000	40,000	235,000	13,119	193,200	42,257	302	33,851	842	34,693
Leyton	* Mar. 31, 1912	Dec., 1906	,,	18	40	306,427	305,821	606	295,526	15,977	256,643	40,906	3,360	61,496	1,172	62,668
Lincoln	* Mar. 31, 1912	Nov., 1905	S.	2	77	98,519	44,940	53,579	44,992	15,187	44,168	8,587	1,488	6,688	126	6,814
Liverpool ...	* Dec. 31, 1912	Nov., 1898	E.	119	0	...	...	...	2,015,193	16,934	1,245,282	1,012,873	430,509	631,071	13,103	644,174
Lowestoft ...	* Sep. 30, 1912	July, 1903	,,	4	6	94,230	87,031	7,199	87,031	21,357	67,833	13,067	...	10,781	17	10,798
Maidstone ...	* Mar. 31, 1912	July, 1904	,,	7	3	82,932	82,582	350	78,748	11,012	69,158	13,424	Nil.	9,279	518	9,797
Manchester ...	† Mar. 31, 1913	June, 1901	,,	188	30	2,355,689	2,034,371	321,318	2,061,791	10,945	1,543,504	437,305	479,683	876,023	11,624	887,647
Nelson	* Mar. 31, 1912	Feb., 1903	,,	3	69	38,000	36,349	1,651	36,430	...	29,602	6,747	...	9,371	41	9,412
Newport (Mon.)...	* Mar. 31, 1912	April, 1903	,,	14	35	219,250	193,250	26,000	192,934	13,363	166,653	35,432	9,958	36,361	821	37,182
Nottingham ...	* Mar. 31, 1912	Jan., 1901	,,	36	40	730,300	...	...	635,128	17,401	439,128	197,036	69,201	160,190	2,408	162,598
Oldham	* Mar. 25, 1912	May, 1902	,,	27 (b) 8	67 31	516,923	436,704	80,219	441,047	15,395	333,746	113,339	(a) 1,419	101,280	819	102,099
Perth	* May 15, 1912	Nov., 1905	,,	6	40	90,000	77,650	12,350	77,829	11,539	64,790	13,678	1,034	9,689	412	10,101(e)
Plymouth ...	* Mar. 31, 1912	Sept., 1899	,,	15	0	...	188,752	...	157,322	...	92,636	97,320	10,848	37,083	830	37,913
Pontypridd ...	* Mar. 31, 1912	Mar., 1905	,,	8	48	136,019	135,885	134	136,896	15,919	112,862	22,899	...	21,130	2,036	23,166
Rawtenstall ...	* Mar. 31, 1912	May, 1909	,,	15	71	196,159	182,933	13,226	181,036	11,401	169,971	12,962	2,150	24,063	1,018	25,081
Rochdale	* Mar. 31, 1912	May, 1902	,,	(i) 40	2	356,991	347,782	9,209	351,831	15,347	347,782	71,729	...	72,649	353	73,002
Rotherham ...	* Mar. 31, 1912	Jan., 1903	,,	12	0	228,550	155,000	73,550	154,589	12,882	132,835	46,413	18,123	35,724	133	35,857
Salford	* Mar. 31, 1912	Oct., 1901	,,	75	0	1,050,666	723,669	326,997	723,324	9,644	581,149	237,090	48,964	253,962	70	254,032
Southampton ...	* Mar. 31, 1912	Jan., 1900	,,	17	62	277,259	239,715	37,544	247,977	13,951	169,010	70,726	18,497	63,849	2,260	66,109
Southend-on-Sea	* Mar. 31, 1912	July, 1901	,,	11	49	130,000	129,961	39	143,808	12,384	116,940	12,784	3,045	34,453	465	34,918
Southport ...	Mar. 31, 1909	July, 1900	,,	10	61	292,000	197,200	94,800	195,967	10,314	144,240	52,960	9,001	19,218	341	19,559
South Shields ...	* Mar. 31, 1912	Mar., 1906	,,	10	21	251,882	174,935	76,947	172,322	16,791	156,111	26,920	15,864	32,160	772	32,932
Staly'ge, H., M., D.	* Mar. 31, 1912	May, 1904	,,	27	57	325,270	273,470	45,800	279,778	10,096	230,488	48,982	173	39,198	365	39,563
Stockport ...	* Mar. 31, 1912	Aug., 1902	,,	27	50	305,028	234,500	70,528	238,199	8,623	176,002	58,498	54,219	59,594	1,245	60,839
Sunderland ...	* Mar. 31, 1912	Aug., 1900	,,	20	35	308,676	303,211	5,465	304,882	14,982	192,752	101,576	29,112	67,871	363	68,234
Wallasey ...	* Mar. 31, 1912	Mar., 1902	,,	19	69	192,546	191,249	1,297	210,671	10,606	167,586	53,395	10,544	57,337	770	58,107
Walsall	* Dec. 31, 1912	Dec., 1902	,,	19	44	188,145	188,100	45	183,351	9,378	156,161	31,939	30,879	30,629	800	31,429
Walthamstow ...	* Mar. 31, 1912	June, 1905	,,	12	42	180,000	180,000	Nil	173,081	13,846	165,679	16,321	2,757	38,249	741	38,990
Warrington ...	* Mar. 31, 1912	April, 1902	,,	9	52	103,674	102,896	778	102,128	10,583	77,094	25,802	10,000	21,338	335	21,673
West Ham ...	* Mar. 31, 1912	Feb., 1904	,,	27	62	563,412	551,463	11,949	553,275	19,919	553,441	77,711	41,944	143,087	1,060	144,147
Wigan	* Mar. 31, 1912	April, 1901	,,	(k) 34	2	492,158	481,022	11,136	472,654	13,891	405,638	115,240	...	66,329	1,241	67,570
Wolverhampton	* Mar. 31, 1912	April, 1902	S.	21	40	279,733	265,616	14,117	277,510	12,908	223,496	55,578	45,891	51,452	807	52,259
Yarmouth (Gt.)...	* Mar. 31, 1912	June, 1902	E.	14	32	144,500	119,750	24,750	121,322	8,425	112,550	19,623	5,739	24,380	520	24,900

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Name.	Year Ended.	Electric Traction Inaugurated.	System.	Line open (single track). Mls.	Line open (single track). Chs.	Borrowing Powers.	Borrowing Powers Exercised.	Unexhausted Borrowing Powers.	Total Capital Expenditure.	Capital Expenditure per Mile of Single Track.	Loans Outstanding.	Loans Repaid and Sinking Fund.	Depreciation, Renewal and Reserve Funds.	Gross Receipts. Traffic.	Gross Receipts. Other.	Gross Receipts. Total.
Belfast	* Mar. 31, 1912	Nov., 1905	E.	81	25	1,556,272	1,131,200	425,072	1,125,864	14,041	1,093,000	152,675	89,406	239,263	3,805	243,068
Bexley	* Mar. 31, 1912	Oct., 1903	,,	6	42	99,942	96,984	2,958	96,924	14,854	78,800	18,184	(j) 1,074	13,826	1,542	15,368
Birkenhead	* Mar. 31, 1912	Feb., 1901	,,	24	7	371,474	364,854	6,620	366,708	15,222	259,103	105,724	15,076	59,282	4,369	63,651
Bournemouth ...	* Mar. 31, 1912	July, 1902	,,	(e) 29	62	449,027	434,462	14,565	438,194	19,601	341,688	113,617	5,656	91,422	233	91,655
Cardiff	* Mar. 31, 1912	May, 1902	,,	31	66	813,923	787,292	26,631	783,051	24,683	583,869	203,422	86,411	125,743	19,181	144,924
Glasgow	* May 31, 1912	Oct., 1898	,,	185 (b) 11	35 29	3,451,487	3,503,174	(g) 51,687	3,532,736	19,051	2,546,923	956,251	1,921,361	987,280	3,795	991,075
Huddersfield ...	* Mar. 31, 1912	Feb., 1901	,,	46	0	646,284	398,942	247,342	416,528	9,055	261,716	146,610	13,253	101,482	3,120	104,602
Hull	* Mar. 31, 1912	July, 1899	,,	29	43	669,273	510,805	158,468	511,273	17,309	505,511	133,787	133,028	151,164	1,622	152,786
Leeds	† Mar. 31, 1913	Aug., 1897	,,	112	62	1,603,455	1,546,422	57,033	1,511,588	13,406	1,220,041	482,698	4,637	407,552	3,979	411,531
Leicester... ...	* Dec. 31, 1912	May, 1904	,,	37	0	739,240	719,223	20,017	722,021	19,514	607,476	129,211	100,000	134,966	12,705	147,671
London	* Mar. 31, 1912	... May, 1903	H. C.E.	23 255	30 60	(c)	(c)	(c)	... 11,850,127	... ...	... 11,309,789	... 2,423,040	... 920,402	60,357 2,231,902	1,335 62,587	61,692 2,294,489
N'castle-on-Tyne	* Mar. 31, 1912	Dec., 1901	E.	60	20	1,520,425	1,199,962	320,463	1,176,339	19,574	932,552	342,271	104,670	216,590	10,044	226,634
Northampton ...	* Mar. 31, 1912	July, 1904	,,	9	13	128,300	127,255	1,045	134,122	14,638	95,488	31,766	10,360	26,784	701	27,485
Portsmouth ...	* Mar. 31, 1912	Sep., 1901	,,	30	66	640,011	682,319	...	696,792	22,599	471,739	210,580	85,307	110,792	1,810	112,602
Preston	* Mar. 31, 1912	June, 1904	,,	17	16	224,101	187,269	36,832	187,269	10,888	129,765	37,200	31,466	40,355	292	40,647
Reading	* Mar. 31, 1912	July, 1903	,,	13	14	235,000	232,000	3,000	227,430	17,262	174,040	51,582	14,651	33,151	1,119	34,270
Sheffield	* Mar. 25, 1912	Sep., 1899	,,	76	58	1,465,674	1,374,390	91,284	1,375,381	18,163	1,071,665	378,280	25,917	337,801	3,203	341,004
Wellington, N.Z.	* Mar. 31, 1912	...	,,	30	7	538,523	538,523	Nil	603,798	20,189	538,523	36,008	87,561	138,229	481	138,710

C = Electric conduit system. E = Electric trolley system. H = Horse lines. S = Surface contact system. (a) Accident insurance fund. (b) Lines leased and worked.
(c) Conferred by Annual Money Act, which limits amount for each financial year. Powers not exercised are lapsed. (e) Includes 7 mi. 34·53 chs. single track lines leased.
(g) Borrowing powers exercised in excess. (h) Includes 1½ miles railless trolley route. (i) 17 mi. 8 chn. single track leased. (j) Including £574 accident insurance fund.
(k) Not including 10 miles 3 chains single track lines leased. (l) Including £1,000 Insurance Fund. † Reports inserted for the financial year 1912-13.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Working Expenses.					Gross Profit on Working.	Additions to Gross Profit.	Deductions from Gross Profit.						Net Surplus + or Deficit −
	Traffic.	General.	Repairs & Maintenance.	Power.	Total.			Interest.	Sinking Fund.	Income Tax.	Depreciation & Renewal.	Sundries.	Total.	
Aberdeen	19,738	8,682	5,740	6,809	40,969	36,211	365	7,561	4,519	...	19,886	214	32,180	+ 4,396
Accrington	6,839	1,870	2,102	4,644	15,455	12,367	...	4,000	3,693	127	...	...	7,820	+ 4,553
Ashton-und'r-Lyne	4,699	1,715	2,358	3,225	11,997	9,894	...	2,814	3,536	440	750	†1,004	8,544	+ 1,350
Ayr	3,403	1,959	1,383	1,925	8,670	7,082	...	2,100	1,669	132	1,966	128	5,995	+ 1,249
Birmingham	160,277	40,898	68,278	100,726	370,179	211,387	11,479	65,672	49,946	...	...	5,896	121,514	+ 101,352
Blackburn	14,863	4,262	12,392	10,999	42,516	24,167	110	5,292	14,909	206	...	...	20,407	+ 3,870
Blackpool	14,325	4,758	12,889	8,262	40,234	25,106	...	(h) 8,721	6,332	...	5,053	...	20,106	+ 5,000
Bolton	28,768	8,846	17,683	20,483	75,780	56,366	1,492	(h) 13,051	16,904	..	16,659	146	46,760	+ 11,098
Bradford	76,831	22,521	36,739	44,044	180,135	109,200	3,279	20,965	31,144	2,894	30,783	4,693	90,479	+ 22,000
Brighton	13,723	4,333	14,127	8,878	41,061	12,967	137	7,897	5,043	...	137	...	13,077	+ 27
Burnley	16,918	6,395	7,474	14,738	45,525	27,184	...	5,786	6,327	911	...	(f) 2,394	15,418	+ 11,766
Burton-on-Trent	5,111	1,322	2,903	2,998	12,334	3,353	...	1,406	1,418	...	1,500	...	4,324	− 971
Bury	14,761	4,349	6,633	8,026	33,769	33,885	337	(h) 7,974	4,824	244	...	(w) 11,608	24,650	+ 9,572
Chester	3,278	1,598	828	2,248	7,952	4,868	95	(h) 2,773	1,018	..	1,172	...	4,963	...
Chesterfield	2,712	1,166	1,469	2,019	7,366	4,839	219	2,426	1,799	...	...	...	4,225	+ 833
Colchester	2,771	1,134	1,584	2,486	7,975	2,759	56	(h) 2,273	2,235	...	...	...	4,508	− 1,693
Croydon	27,695	6,641	11,400	15,914	61,650	32,780	807	8,046	7,428	809	...	...	16,283	+ 17,304
Darlington	4,029	705	1,790	1,985	8,059	3,365	105	2,097	1,967	108	316	...	4,488	− 1,018
Darwen	3,448	754	2,627	2,232	9,061	5,710	111	2,314	2,186	...	1,050	...	5,550	+ 271
Derby	E 16,132 H 558	2,434 ...	4,428 55	9,026 ...	32,020 613	15,343 def. 188	266	6,944	3,274	...	...	(l) 208	10,426	+ 5,183
Doncaster	4,071	940	4,325	3,918	13,254	4,415	186	2,744	1,309	...	107	441	4,601	...
Dundee	16,160	4,963	7,262	10,999	39,384	23,296	...	8,635	5,950	217	6,902	546	22,250	+ 1,046
East Ham	16,218	6,024	10,014	9,415	41,671	16,339	...	(h) 5,846	6,555	...	517	85	13,003	+ 3,336
Exeter	4,571	1,429	1,231	3,643	10,874	6,416	...	2,384	1,749	16	...	...	4,149	+ 2,267
Gloucester	6,346	1,593	2,358	1,991	12,288	4,714	...	4,813	2,218	...	...	...	7,031	− 2,317
Halifax	25,150	6,073	14,705	16,962	62,890	39,003	...	10,381	10,196	...	13,214	405	34,196	+ 4,807
Ilford	8,930	2,010	4,838	4,664	20,442	9,124	557	4,315	4,725	...	641	...	9,681	...
Ilkeston	2,359	579	1,613	1,476	6,027	662	157	1,578	1,644	..	...	210	3,432	− 2,613
Ipswich	8,072	1,827	4,015	3,502	17,416	5,988	...	(h) 3,642	2,078	...	...	...	5,720	+ 268
Keighley	2,769	724	940	1,551	5,984	3,855	224	1,160	1,815	...	...	(n) 1,104	4,079	...
Kilmarnock	3,271	774	988	1,754	6,787	1,850	7	(h) 1,637	1,238	2	1,160	...	4,037	− 2,180
Kirkcaldy	4,741	1,474	1,324	2,436	9,975	6,090	...	2,695	1,551	...	409	111	4,766	+ 1,324
Lancaster	2,289	505	916	1,694	5,404	306	92	1,352	1,425	...	...	...	2,777	− 2,379
Leith	9,057	2,439	3,588	3,147	18,231	16,452	86	(h) 6,566	7,750	...	...	139	14,455	+ 2,093
Leyton	(p) 16,573	5,056	8,211	11,672	41,512	21,156	...	10,340	7,596	...	1,478	264	19,678	+ 1,478
Lincoln	1,487	615	1,054	926	4,082	2,732	8	1,529	1,071	...	...	...	2,600	+ 140
Liverpool	167,045	58,771	80,184	113,893	419,893	224,281	24,045	50,096	59,155	...	(d) 66,929	(e) 5,217	181,397	+ 66,929
Lowestoft	3,285	796	2,115	2,813	9,009	1,789	..	(h) 2,261	1,562	...	...	350	4,173	− 2,384
Maidstone	2,324	1,077	1,139	1,868	6,408	3,389	58	(h) 2,797	2,185	...	...	74	5,056	− 1,609
Manchester	255,604	83,574	84,879	133,681	557,738	329,909	14,282	55,771	52,394	8,613	101,466	(c) 25,947	244,191	+ 100,000
Nelson	2,241	587	1,689	1,965	6,482	2,930	...	993	938	...	...	...	1,931	+ 999
Newport (Mon.)	9,900	3,230	5,882	7,516	26,528	10,654	904	6,145	4,074	...	...	...	10,219	+ 1,339
Nottingham	41,707	14,419	17,775	32,261	106,162	56,436	...	14,970	19,303	...	...	...	34,273	+ 22,163
Oldham	25,086	6,931	17,077	22,090	71,184	50,915	1,369	15,448	11,501	1,636	...	(k) 6,112	34,697	− 2,413
Perth	3,795	680	450	1,347	6,272	3,829	45	2,332	2,006	2	640	51	5,031	− 1,157
Plymouth	7,933	3,542	5,029	7,577	24,081	13,832	1,258	4,778	3,931	...	3,354	...	12,063	+ 3,027
Pontypridd	5,307	1,469	6,611	3,656	17,043	6,123	5	(h) 4,293	4,034	...	590	41	8,958	− 2,830
Rawtenstall	5,292	2,216	2,049	3,958	13,515	11,566	(q) 1,663	6,148	5,531	...	...	...	11,679	+ 1,550
Rochdale	16,421	4,475	6,944	9,527	37,367	35,635	246	11,380	9,594	694	...	(z) 7,727	29,395	+ 6,486
Rotherham	8,991	2,539	5,187	8,497	25,214	10,643	944	4,393	2,737	...	3,707	...	10,837	+ 750
Salford	67,947	16,384	24,721	47,166	156,218	97,814	5,158	19,550	23,846	2,295	9,569	(k) 29,712	84,972	+ 18,000
Southampton	17,703	4,879	8,782	12,454	43,818	22,291	6,099	6,779	6,578	574	...	488	14,419	+ 13,971
Southend-on-Sea	8,046	2,260	3,534	6,187	20,027	14,891	4,228	(h) 3,835	1,753	...	4,017	...	9,605	+ 9,514
Southport	4,754	2,016	1,963	3,357	12,090	7,469	6,421	6,422	4,966	...	1,997	40	13,425	+ 465
South Shields	7,642	3,002	2,471	5,311	18,426	14,506	274	(h) 5,615	3,501	...	...	...	9,116	+ 5,664
Staly'dge, H., M., D.	13,716	4,839	5,669	6,079	30,303	9,260	...	(h) 7,948	7,095	...	173	516	15,732	− 6,472
Stockport	12,436	3,717	6,437	4,781	27,371	33,468	1,326	5,978	8,363	910	6,795	3,208	25,254	+ 9,540
Sunderland	18,517	5,181	4,503	10,754	38,955	29,279	408	(h) 7,263	9,880	271	6,818	455	24,687	+ 5,000
Wallasey	16,074	4,027	5,281	12,979	38,361	19,746	474	6,270	4,383	...	2,500	633	13,786	+ 6,434
Walsall	7,155	3,034	4,126	3,913	18,228	13,201	1,334	5,164	3,577	415	368	1,119	10,643	+ 3,892
Walthamstow	13,413	2,547	5,204	7,423	28,587	10,403	210	(h) 6,214	2,599	...	...	...	8,813	+ 1,800
Warrington	5,318	1,547	3,252	3,315	13,432	8,241	63	2,689	3,159	...	...	...	5,848	+ 2,456
West Ham	49,252	12,386	20,005	22,055	103,698	36,417	979	20,154	12,289	444	426	...	33,313	+ 4,083
Wigan	15,468	5,227	9,664	10,837	41,196	26,374	95	(h) 14,575	12,269	...	...	3,714	30,558	+ 4,088
Wolverhampton	12,184	3,891	7,273	6,300	29,648	22,611	(x) 890	7,924	4,990	200	3,882	9	17,005	+ 6,496
Yarmouth (Gt.)	7,482	1,835	2,968	4,031	16,316	8,584	110	(h) 4,014	2,699	...	1,250	113	8,076	+ 618

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast	68,080	12,678	28,395	20,190	129,343	113,725	750	39,647	24,554	1,082	13,000	3,359	81,642	+ 32,833
Bexley	(s) 5,465	984	1,892	920	9,261	6,107	...	2,942	2,325	...	500	...	5,767	+ 340
Birkenhead	15,706	4,055	10,609	9,232	39,602	24,049	...	11,626	9,502	143	2,479	299	24,049	...
Bournemouth	22,385	7,624	11,045	13,787	54,841	36,814	838	10,852	15,521	...	...	(e) 7,900	34,273	+ 3,379
Cardiff	37,145	(c) 10,512	14,894	17,223	79,774	65,150	1,529	24,327	23,079	750	6,947	...	55,103	+ 11,576
Glasgow	295,525	116,405	125,844	44,866	582,640	408,435	49,772	75,092	93,864	13,028	213,704	10,452	406,140	+ 52,067
Huddersfield	24,351	5,803	17,989	9,096	57,239	47,363	6,458	(h) 11,522	10,139	1,426	17,780	15	40,882	+ 12,939
Hull	43,701	12,183	31,384	10,676	97,944	54,842	1,193	15,236	11,335	1,433	...	(a) 6,920	34,924	+ 21,111
Leeds	109,413	36,055	39,894	28,455	213,817	197,714	7,511	42,197	49,923	5,021	41,752	4,957	143,850	+ 61,375
Leicester	47,876	9,497	22,023	15,633	95,029	52,642	2,312	23,252	12,095	1,939	7,668	...	44,954	+ 10,000
London	H 28,811 E 696,620	4,371 (r) 188,382	7,782 295,669	(m) 32,694 167,639	73,658 1,348,310	def. 11,966 946,179	... 29,440	334,173	369,356	22,858	138,152	(l) 26,529	891,068	+ 84,551
N'castle-on-Tyne	60,663	17,730	29,951	(g) 13,668	122,012	104,622	3,598	30,972	39,314	2,697	8,427	(j) 13,368	94,778	+ 13,442
Northampton	6,774	1,886	2,237	3,496	14,393	13,092	845	(h) 3,637	4,206	244	1,776	(b) 874	10,737	+ 3,200
Portsmouth	28,392	9,780	9,225	4,482	51,879	60,723	2,677	20,798	17,458	1,109	8,694	1,273	49,332	+ 14,068
Preston	10,630	5,144	5,847	2,351	23,972	16,675	...	4,324	4,749	...	...	1,361	10,434	+ 6,241
Reading	8,518	3,545	4,307	3,246	19,616	14,654	...	6,626	4,662	162	...	...	11,450	+ 3,204
Sheffield	108,738	25,139	38,542	24,188	196,607	144,397	3,129	40,960	41,527	3,705	25,411	2	111,605	+ 35,921
Wellington, N.Z.	53,887	7,505	23,067	15,451	99,910	38,800	978	20,320	4,794	...	17,489	...	42,603	− 2,825

(a) Includes £4,393 loss on motor omnibuses. (b) Includes £537 loss on omnibus account. (c) Includes £1,570 insurance fund. (d) Includes reserve.
(e) Rents for leased lines. (f) £2,061 rent of leased lines. (g) Including street lighting. (h) Including income tax. (i) Accrued interest.
(j) Including £12,250 commuted payment to Newcastle Electric Supply Company. (k) Includes rents of lines. (l) Including loss on horse traction.
(m) Horsing expenses. (n) Transferred to motor omnibus capital account. (o) Including £9,612 for lighting generation. (p) Includes £243 horse account.
(q) Aid from rates £1,500. (r) Including special charges, £17,478. (s) Including £2,128 through-running expenses.
(w) Amount apportioned to leased lines. (x) Includes £191 profit on motor char-a-banc. (z) Includes £4,386 rent of leased lines.
† This item includes £734 payable to Sinking Fund of Hurst U.D.C.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Appropriation of Net Surplus.			Receipts per Car Mile.		Operating Expenses per Car Mile.					Percentage of Operating Expenses to Total Revenue.	Average Operating Expenses per Car Mile (excludi'g Power Cost).	Board of Trade Units.		
	Carried Forward.	Reserve.	Contribution to Rates or Municip'l Funds.	Average Total per Car Mile. d.	Average Traffic per Car Mile. d.	Traffic. d.	General. d.	Repairs and Maintenance. d.	Power. (Price paid) d.	Total. d.	%	d.	Units.	Cost per Unit. d.	Units used per car mile.
Aberdeen ...	...	4,396	...	11·27	11·12	2·888	1·268	·870	·994	5·98	53·08	4·986	1,893,077	·86	1·152
Accrington ...	460	3,359	724	12·57	12·38	3·09	·84	·95	2·10	6·98	55·55	4·88	907,721	1·24	1·70
Ashton-u-Lyne	...	...	1,350	11·475	11·186	2·463	·899	1·236	1·691	6·289	54·801	4·598	619,289	1·25	1·353
Ayr...	..	...	1,249	9·79	9·38	2·11	1·21	·86	1·19	5·39	55	4·19	374,296	1·24	·97
Birmingham ...	56,352	45,000	...	10·62	10·492	2·929	·747	1·248	1·840	6·764	63·6	4·924	21,591,889	1·119	1·64
Blackburn ...	3,870	...	...	14·02	13·34	3·12	·90	2·61	2·31	8·94	56·84	6·63	2,030,535	1·3	1·81
Blackpool ..	...	...	5,000	16·63	16·37	3·65	1·21	3·28	2·10	10·24	61·57	8·14	1,238,641	1·60	1·31
Bolton	518	...	10,500	11·364	11·279	2·474	·761	1·521	1·761	6·517	57·778	4·752	4,468,961	1·1	1·601
Bradford	...	...	22,000	12·211	11·600	3·398	·700	1·320	1·545	6·963	62·259	5·418	10,574,643	1	1·830
Brighton	27	...	...	11·384	10·987	2·891	·914	2·976	1·871	8·652	76	6·781	1,775,559	1·2	1·56
Burnley	...	4,466	7,300	12·610	12·566	2·934	1·109	1·296	2·556	7·895	62·74	5·32	2,855,006	1·24	2·05
Burton-on-Trent	...	...	...	8·61	7·90	2·81	·73	1·45	1·42	6·41	78·7	4·99	515,622	1·39	1·01
Bury	...	(i) 4,572	5,000	10·22	10·04	2·214	·685	1·152	1·290	5·341	49·91	4·051	2,039,011	·94	1·271
Chester	...	...	...	8·84	8·51	2·26	1·10	·57	1·55	5·48	62	3·93	397,691	·764	1·14
Chesterfield ...	...	833	...	10·10	9·69	2·24	·96	1·22	1·68	6·1	59·6	4·43	387,704	1·25	1·3
Colchester ..	...	...	...	7·959	7·625	2·055	·84	1·174	1·844	5·913	73·95	4·069	397,795	1·50	1·23
Croydon	...	9,304	8,000	9·234	9·049	2·791	·671	1·139	1·556	6·157	64·73	4·474	2,287,566	1·554	·929
Darlington ...	...	...	...	7·488	7·246	2·540	·444	1·129	1·252	5·365	71·66	4·113	476,444	1	1·252
Darwen	271	...	...	14·18	13·9	3·645	·708	2·224	2·507	9·084	61·3	6·55	421,503	1·313	1·68
Derby	5,183	...	...	E 9·79 H. 5·70	9·50 5·47	3·33 7·49	·50 ...	·92 ·74	1·87 ...	6·62 8·23	67·60 144·21	4·75 ..	1,480,150 ...	1·50&1·45 ...	1·274 ...
Doncaster ..	...	...	...	8·49	8·29	1·94	·44	2·06	1·86	6·30	75·1	4·44	683,855	1·375	1·35
Dundee ...	...	46	1,000	11·263	10·980	2·904	·891	1·306	1·976	7·077	61·9	5·10	2,356,993	1·125	1·764
East Ham	.	...	...	10·39	10·26	2·90	1·08	1·79	1·69	7·46	71·8	5·77	1,995,635	1·125	1·49
Exeter	...	2,267	...	9·653	9·653	2·552	·798	·687	2·034	6·071	62·89	4·037	537,997	1·625	1·251
Gloucester	...	...	...	6·694	6·258	2·498	·627	·929	·784	4·838	72	4·054	472,359	1	·77
Halifax	...	...	4,807	11·630	11·515	2·871	·693	1·678	1·936	7·178	62	5·242	3,563,953	1·125	1·69
Ilford	..	...	...	9·356	9·186	2·826	·636	1·531	1·476	6·469	69·2	4·993	994,999	1·125	1·31
Ilkeston	...	...	...	6·73	6·57	2·36	·58	1·63	1·49	6·06	90·25	4·57	339,920	1·042	1·4
Ipswich	268	...	...	8·408	8·110	2·900	·657	1·442	1·258	6·257	74·41	4·999	672,411	1·25	1·007
Keighley	...	...	...	9·721	9·473	2·736	·715	·929	1·532	5·912	61	4·380	248,096	1·5	1·021
Kilmarnock .	...	...	...	6·709	6·525	2·541	·601	·769	1·362	5·273	78·6	3·911	336,801	1·25	1·09
Kirkcaldy .	1,324	...	...	8·152	7·908	2·406	·748	·672	1·236	5·062	64	3·82	668,134	·875	1·413
Lancaster ..	...	...	...	7·55	7·87	3·105	·681	1·246	2·298	7·33	93	5·03	239,119	1·7	1·35
Leith	2,093	...	...	8·72	8·51	2·28	·61	·91	·78	4·58	52·54	3·8	863,202	·875	·9
Leyton	1,478	...	...	10·365	10·142	(c) 3·143	·964	1·417	1·711	7·235	66·241	5·524	2,542,672	1·078	1·587
Lincoln	140	...	...	10·12	9·92	2·20	·92	1·56	1·37	6·05	59·8	4·68	184,710	1·25	1·098
Liverpool .	...	...	66,929	12·03	12·28	3·184	1·120	1·529	2·171	8·004	63·6	5·833	...	...	...
Lowestoft .	...	...	...	8·3	8·3	2·5	·6	1·6	2·18	6·9	83·40	4·8	385,731	1·75	1·2
Maidstone	...	...	...	8·19	7·77	1·942	·900	·952	1·56	5·344	69	3·79	358,616	1·25	1·25
Manchester .	...	...	100,000	11·351	11·202	3·269	1·069	1·085	1·709	7·132	62·83	5·423	30,492,127	1·046	1·625
Nelson	999	...	...	11·38	11·34	2·71	·71	2·04	2·38	7·84	69	5·46	235,288	2	1·19
Newport (Mon.)..	...	(h) 1,339	...	9·678	9·464	2·577	·840	1·532	1·956	6·905	71·40	4·949	1,389,504	1·25	1·51
Nottingham ..	...	4,163	18,000	11·22	11·06	2·34	1·56	1·20	2·22	7·32	65·29	5·10	6,039,203	1·25	1·73
Oldham	...	..	...	12·616	12·515	3·100	·857	2·110	2·729	8·796	69·72	6·067	3,541,360	1·375	1·823
Perth	...	...	...	8·88	8·46	3·59	·64	·43	1·27	5·93	59	4·04	289,473	1·083	1·17
Plymouth ..	...	...	3,027	11·253	11·007	2·346	1·041	1·488	2·247	7·122	63·52	4·875	1,087,297	1·672	1·34
Pontypridd ..	...	...	...	10·92	10·78	2·71	·75	3·37	1·87	8·70	80·65	6·83	701,941	1·25	1·49
Rawtenstall ..	...	1,550	...	11·16	10·71	2·35	·98	·92	1·76	6·01	53·54	4·25	687,821	1·381	1·27
Rochdale... ..	6,486	...	...	11·020	10·966	2·479	·691	1·067	1·533	5·770	51·2	4·237	2,250,037	1·016	1·508
Rotherham ..	...	...	750	11·950	11·906	2·996	·846	1·729	2·832	8·403	70·32	5·571	1,359,602	1·5	1·88
Salford	...	...	18,000	10·497	10·494	2·807	·677	1·022	1·949	6·455	62	4·506	9,137,678	1·238	1·58
Southampton ..	8,971	...	5,000	10·672	10·307	2·857	·788	1·418	2·010	7·073	66·3	5·063	1,874,217	1·625	1·266
Southend-on-Se:	2,514	1,000	6,000	13·14	12·97	3·03	·85	1·33	2·33	7·54	57·35	5·21	848,538	1·75	1·33
Southport ..	...	...	...	10·294	10·115	2·502	1·06	1·033	1·767	6·363	61·8	4·596	522,972	1·5	1·182
South Shields ..	(d) 500	5,164	...	9·710	9·483	2·253	·885	·729	1·566	5·433	55·95	3·867	904,332	1·4094	1·111
Stalybridge, &c.	...	...	...	7·640	7·569	2·649	·934	1·095	1·174	5·852	76·34	4·678	1,947,561	·75	1·567
Stockport		540	9,000	10·434	10·221	2·133	·638	1·103	·820	4·694	44·99	3·874	1,704,943	1·036	1·218
Sunderland ..	...	...	5,000	10·917	10·859	2·962	·829	·721	1·721	6·233	56·32	4·512	1,720,607	1·5	1·14
Wallasey . ..	234	(f) 200	6,000	11·357	11·207	3·142	(g) ·787	1·032	2·563	7·497	66	4·96	1,916,450	1·625	1·56
Walsall	3,392	...	500	11·326	11·038	2·578	1·094	1·487	1·410	6·569	58	5·159	780,825	1·25	1·172
Walthamstow ..	1,800	...	...	9·31	9·13	3·20	·61	1·24	1·77	6·82	73·32	5·05	1,188,326	1·5	1·18
Warrington ..	338	618	1,500	11·727	11·545	2·877	·837	1·760	1·794	7·268	61·796	5·474	530,436	1·5	1·196
West Ham ..	...	4,083	...	10·44	10·33	3·659	·904	1·461	1·609	7·633	72	6·024	5,571,743	·95	1·69
Wigan	...	...	...	11·206	11·007	2·565	·866	1·603	1·798	6·832	60·97	5·03	2,190,122	1·187	1·52
Wolverhampton	...	2,719	3,777	10·967	10·798	2·557	·817	1·526	1·322	6·222	56·73	4·90	1,508,410	1	1·319
Yarmouth (Gt.)..	618	...	...	8·962	8·775	2·695	·660	1·067	1·450	5·872	66·92	4·422	643,282	1·50	·964

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

									*					Works Cost.	
Belfast	...	...	32,833	10·29	10·12	2·88	·54	1·20	·85	5·47	53·21	4·62	7,734,501	·626	1·36
Bexley	40	..	...	12·8	12·63	3·04	·89	1·75	·87	6·55	60·3	5·68	350,103	·63	1·37
Birkenhead ...	...	...	...	11·77	11·609	3·075	·793	2·076	1·166	7·110	60·37	5·98	2,454,214	·561	2·002
Bournemouth .	...	3,379	...	11·92	11·89	2·91	·99	1·44	(b) 1·79	7·13	59·83	5·34	2,743,998	·576	1·48
Cardiff	6,926	...	4,650	13·45	11·65	3·446	·976	1·382	·634	6·438	55	5·804	3,864,260	·415	1·49
Glasgow	...	...	52,067	10·602	10·561	3·162	1·245	1·346	·480	6·233	55·98	5·753	30,261,134	·355	1·35
Huddersfield ...	6,481	...	6,458	11·18	10·85	2·60	·62	1·93	·97	6·12	54·72	5·15	5,120,215	·65	2·22
Hull	...	9,111	12,000	9·75	9·65	2·81	·78	2·00	·68	6·27	63·72	5·47	4,728,903	·55	1·26
Leeds	...	...	61,375	11·229	11·120	2·985	·984	1·089	·776	5·834	51·95	5·058	16,461,894	·440	1·807
Leicester... .	...	...	10,000	9·675	8·843	3·137	·622	1·443	1·024	6·226	64	5·202	6,558,800	·3645	1·79
London	...	H.84,551	...	H. 8·81 E. 11·29	8·62 10·98	4·12 3·42	·62 ·93	1·11 1·45	4·67 ·83	10·52 6·63	119·40 58·76	10·52 5·80	... 122,307,298	... ·61	... 2·51
N'castle-on-Tyne	...	...	13,442	11·841	11·317	3·170	·926	1·565	(a) ·714	6·375	52·23	5·661	8,745,068	·356	1·904
Northampton ...	...	1,200	2,000	10·11	9·85	2·51	·67	·82	1·29	5·29	52	4·00	1,032,199	·81	1·58
Portsmouth ...	8,068	(f) 2,000	4,000	12·261	12·069	3·092	1·065	1·004	·488	5·649	46·08	5·161	2,583,580	·448	1·041
Preston	...	6,241	...	10·415	10·34	2·724	1·319	1·499	·602	6·144	59·22	5·542	1,377,176	·409	1·236
Reading	...	1,344	1,860	8·968	8·676	2·229	·928	1·127	·849	5·133	57	4·28	955,400	·815	·90
Sheffield	...	2,000	33,921	10·601	10·501	3·380	·782	1·198	·752	6·112	57·655	5·360	15,603,810	·642	1·784
Wellington, N.Z.	...	...	...	14·615	14·666	5·698	·793	2·439	1·634	10·564	72·03	8·93	4,873,707	·765	2·14

H—Horse lines. E—Electric trolley system. * The figures given under "Power" in Table II. include actual works costs only. (a) Including power and street lighting. (b) Including ·98d. per car mile current supplied by Bournemouth and Poole Supply Company. (c) Horse account ·050d. (d) Accident, insurance, and compensation fund. (e) Total B.O.T. units, including lighting, 10,215,925. (f) Insurance fund. (g) Including ·09d. to Superannuation Fund. (h) Renewals Fund. (i) Including £1,000 Insurance Fund.

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RECORDS OF ELECTRIC TRAMWAY ACCOUNTS.

Specially Compiled for "The Tramway and Railway World."

TABLE I.—TOWNS WITH COMBINED GENERATING STATION FOR TRACTION AND LIGHTING PURPOSES.

Name.	Population Served.	Car Mileage.	Passengers Carried.	Traffic Records. Passengers Carried per Car Mile	Average Fare per Passenger. d	Average Journeys per Head of Populat'n per Annum.	Average Car Miles per Day per Car.	Traffic Revenue per Mile of Single Track. £	Average Traffic Revenue per Annum per Head of Populat'n Served.	Operating Expenses per Passenger. d.	Average Distance of 1d. Fare. Miles.	Average Fare Charged per Mile. d.	Average Speed per Hour. Miles.	Average Total Car Hours per Day.	Average Number of Cars in Use Daily.	Number of Cars in Stock.
Aberdeen ...	165,000	1,643,247	19,054,847	11·59	·96	121·5	99·7	2,744	9/3	·516	1·7	·6	7·5	640	45	71
Accrington...	70,000	531,356	4,577,019	8·6	1·43	65·3	105	2,572	7/10	·81	1·07	·929	7·5	242	17	27
Ashton-u-L.	50,000	457,856	4,754,139	10·383	1·077	95·083	104	2,606	8/6	·606	1·223	·81	8	204	12	21
Ayr	33,000	385,796	3,739,237	9·69	·96	113	106	1,981	9/2	·556	1·25	·75	8	14	10	20
Birmingham	...	13,134,642	134,467,166	10·23	1·025	...	81·06	5,298	..	·66	...	..	...	...	...	...
Blackburn ...	200,000	1,141,161	11,721,367	10·88	1·27	58·61	105	2,564	6/4	·87	1·25	·76	7·50	434	31	61
Blackpool ...	67,000	942,829	10,339,719	11	1·36	154·4	83	3,705	19/2	·934	...	...	8	...	31	72
Bolton ...	221,000	2,792,236	29,319,812	10·50	1·073	132·669	120·66	2,790	11/10	·654	1·468	·627	7·25	1,030	60	106
Bradford ...	337,000	5,686,653	56,352,281	9·91	1·168	167	113·72	2,717	16/3	·767	1·60	·514	7·3	2,123·5	137	239
Brighton ...	131,444	1,139,048	11,382,406	10	1·10	86·6	91·76	3,033	7/11	·865	1·27	·788	6·41	544	34	50
Burnley ...	170,000	1,383,822	14,468,231	10·46	1·19	85	100	3,450	8/6	·755	1·25	·83	7	764	36	57
Burton ...	48,000	437,106	3,188,655	7·30	1·082	66	...	1,684	5/10	·928	1·506	·58	7·5	...	...	20
Bury	128,202	1,899,872	15,132,553	9	1·07	118·03	102·33	1,957	10/6	·535	1·24	·85	8·56	506·64	42·71	50
Chester ...	39,038	347,904	3,078,564	8·85	·96	2·34	95	1,944	6/4	·622	1·27	·8	7	150·6	10·04	18
Chesterfield	38,000	289,890	2,519,533	8·69	1·1	66	132	2,249	6/5	·702	1·38	·75	7·33	117	6·5	14
Colchester ...	43,452	323,693	1,828,878	5·65	1·34	41·85	89·2	1,295	4/9	1·04	·89	1·10	6·84	149·79	10·26	18
Croydon ...	167,918	2,462,468	20,849,230	8·494	1·065	124·16	118	4,838	11/4	·710	2·206	·49	7·88	843·92	56	75
Darlington...	56,800	380,872	3,674,075	9·6	·751	64·68	94·5	1,295	4/-	·556	1·098	·9	6·66	151·25	11	16
Darwen ...	40,611	249,950	2,785,037	11·1	1·17	68·5	40	2,029	7/2	·781	1·06	·78	8	115·56	6·42	17
Derby ...	124,544	E 1,161,398 H. 17,876	10,604,977 98,364	9·13 5·44	1·05 ·993	85·15	...	2,103 ...	7/5 ...	·724 1·49	1·44 1	·75 1	6·375 ..	... ...	... ...	50 ...
Doncaster ...	50,000	504,250	4,532,625	8·98	·922	90·65	115	1,479	7/-	·702	1·25	·76	7·5	221	14	25
Dundee ...	165,000	1,335,512	17,022,560	12·74	·861	103	87	2,222	7/7	·555	2	·50	7·3	555	42	66
East Ham ...	133,000	1,340,252	17,789,734	13·27	·77	134	...	3,981	8/7	·56	1·63	·65	...	...	...	45
Exeter ...	48,500	429,878	4,241,671	9·87	·977	87·5	81	2,470	7/2	·615	1	1	6	224	16	20
Gloucester ...	52,795	609,531	4,111,175	6·7	·92	77	92·5	1,059	6/-	·70	1·5	·65	7·11	243	18	30
Halifax ...	176,000	2,102,757	18,749,456	8·92	1·26	107	77	1,859	11/6	·805	1·35	·84	6·6	803	73	95
Ilford ...	80,000	758,456	7,784,992	11·21	·84	97·31	130	2,560	6/10	·630	1·843	·69	8	...	16	26
Ilkeston ...	32,000	238,645	1,732,846	7·25	·9	54	117	1,713	6/1	·836	3·2	·35	7·5	108	7·5	13
Ipswich ...	75,300	668,025	5,554,585	8·31	·975	73·76	65·5	1,518	6/-	·75	1·53	·693	6·17	234·19	20·78	36
Keighley ...	42,000	242,919	2,245,120	9·242	·98	53·45	55·42	1,568	4/7	·639	2·22	·45	6·87	126	7	12
Kilmarnock	36,000	308,976	2,268,033	7·34	·88	63	90·34	1,508	4/8	·728	1·13	·86	7·22	116·5	9·37	14
Kirkcaldy ...	39,600	472,928	5,198,320	10·9	·719	131·2	52	1,771	7/11	·460	1·522	·75	7	169	16	22
Lancaster ...	41,414	176,903	1,473,987	8·33	·906	36	76	1,159	2/8	·88	1·71	·5	6	88·90	6·35	12
Leith ...	81,000	954,563	9,339,324	9·7	·87	115·30	123	1,880	8/4	·46	1·32	·72	8·2	320	21·33	37
Leyton ...	124,736	1,601,833	16,897,512	10·549	·873	135	104	3,324	9/10	·590	...	...	7·70	574·56	42	60
Lincoln ...	20,000	161,897	1,712,109	10·57	·93	85·6	64·7	2,255	6/8	·572	1·75	·428	7	90	5	8
Liverpool ...	...	12,590,408	134,249,967	10·66	1·128	...	...	5,303	...	·756	2·45	...	...	...	445	587
Lowestoft ...	35,000	308,897	2,462,188	8	1·05	70·35	...	2,646	6/2	·878	univ'rs'l penny fare		...	...	..	19
Maidstone ...	25,000	287,179	2,096,488	7·3	1·062	83·85	70	1,319	7/5	·73	1	1	6·7	128	12	19
Manchester	950,000	18,768,259	187,675,183	10	1·12	198	95·8	4,990	17/5	·713	...	...	...	...	...	629
Nelson ...	45,000	198,414	2,509,514	12·65	·89	55·77	90·35	2,425	4/2	·619	1	1	5·50	108	6	9
Newport ...	85,634	922,064	8,937,257	9·69	·998	104·4	109	2,518	8/6	·488	1/4·68	·66	6·77	18½	27	44
Nottingham	260,000	3,476,262	36,026,471	10·36	1·06	138	95·74	4,388	12/4	·70	1·68	·65	6·86	...	100	135
Oldham ...	180,000	1,942,147	20,073,483	10·335	1·19	111·51	106·5	2,796	11/3	·851	1·12	·684	6·56	800	50	92
Perth... ...	35,900	253,851	1,861,145	7·33	1·15	51·84	96·25	1,892	5/5	·72	..	...	6·25	120	8	12
Plymouth ...	112,000	809,036	8,666,269	10·71	1·026	77·377	93·5	...	6/8	·667	...	...	...	25·5	...	42
Pontypridd...	40,000	470,215	4,721,110	10·04	1·07	118	83·4	2,457	10/7	·77	1·25	·51	6·5	234	18	26
Rawtenstall	30,516	539,320	4,669,522	8·66	1·24	93·39	123	1,515	15/9	·69	1·12	·88	9	16½	12	22
Rochdale ...	130,000	1,589,866	12,711,114	7·99	1·35	97·7	114·90	1,825	11/2	·76	1·07	·90	7·66	645	43	69
Rotherham...	64,000	720,133	7,813,922	10·85	1·097	122·1	116	2,977	11/2	·774	1·5	1	12	19	20	36
Salford ...	350,000	5,808,369	48,720,788	8·38	1·30	139	114	3,386	14/6	·76	1·85	·55	7·96	2,135	140	200
Southampt'n	122,200	1,486,746	12,348,658	8·306	1·241	101	...	3,592	10/5	·85	...	...	...	...	...	68
Southend ...	78,000	637,366	7,581,104	11·89	1·09	97·2	87	4,708	8/10	·634	1·41	·76	...	...	...	31
Southport ...	33,792	455,967	4,371,296	9·586	1·05	129·3	103·8	1,770	11/4	·66	1·6	·619	6·6	204	14·3	26
So'th Shields	108,649	813,947	8,032,488	9·868	·957	73·9	129·2	3,138	5/2	·555	1·825	·54	7·61	282	16	35
Stalybridge	92,585	1,242,777	10,256,918	8·253	·907	110·5	...	1,445	8/5	·709	1·275	·784	6·8	...	...	60
Stockport	120,000	1,399,314	10,665,098	7·6	1·341	88·8	76·6	2,158	9/11·3	·615	1·25	·72	7·5	465	38	50
Sunderland	170,000	1,500,015	16,783,776	11·1	·970	98·7	79·4	3,335	8/-	·550	1·34	·68	7	672	42	70
Wallasey ...	81,000	1,227,935	11,459,807	9·33	1·20	141·48	98·6	2,887	14/2	·803	1·99	·52	7	590	42	55
Walsall ...	100,000	665,964	5,683,798	8·535	1·293	87	57	1,750	6/1	·769	1·24	·77	7	315	21	39
Walth'mst'w	126,000	1,004,872	12,049,323	11·99	·762	95·63	97	3,052	6/1	·569	1·15	·89	7·2	408	36	38
Warrington	86,000	443,550	5,647,137	12·731	·907	65·664	102·15	2,251	4/11	·57	1·246	·803	6·384	189·84	11·865	21
West Ham ..	291,900	3,287,917	41,017,938	12·47	·827	140	92	5,089	9/10	·61	1·79	·57	7·33	1,255·5	93	118
Wigan ...	200,000	1,447,048	12,112,333	8·37	1·314	65·6	96	2,140	6/7	·816	1·47	·9	7·4	800	40	67
Wolverh'ton	135,000	1,143,542	11,253,196	9·84	1·09	83·36	87	2,393	7/7	·626	1·149	·923	6·85	612	36	49
Yarmouth ...	52,000	666,793	4,633,251	6·95	1·265	12·823	73·07	1,681	9/4·5	·845	1·25	·76	7	375	25	35

TABLE II.—TOWNS WITH SEPARATE GENERATING STATIONS FOR TRACTION.

Belfast ...	385,492	5,671,776	54,546,856	9·62	1·05	141	128	3,107	12/5	·57	1·96	·43	8·75	1,776	(b) 224	250
Bexley ...	16,000	262,658	2,130,189	8·11	1·56	133	...	2,360	18/11	·95	1·37	·62	7·5	...	8	16
Birkenhead	130,832	1,225,544	13,273,858	10·83	1·072	101·46	68·96	2,461	9/1	·716	1·39	·70	6·61	494·48	48·55	59
Bournem'uth	120,000	1,844,507	15,121,935	8·09	1·45	126	84·23	3,069	15/3	·87	1·19	·87	6·80	820	60	81
Cardiff ...	182,729	2,586,421	27,561,652	10·66	1·09	151	98·5	3,947	13/9	·69	1·44	·736	7·5	1,104	69	130
Glasgow ...	1,150,000	22,435,076	275,610,385	12·285	·860	239·66	105·29	5,037	17/2	·507	2·31	·44	8·13	8,150·63	582·19	808
Huddersfield	150,000	(a) 2,245,427	20,471,968	9·15	1·13	136	118	3,487	13/7	·67	1·31	·71	7·41	828·96	51·81	86
Hull	282,987	3,761,809	41,277,202	10·97	·87	148·06	123·82	5,117	10/8	·564	2·75	·36	9	1,328·16	83·01	151
Leeds ...	500,000	8,795,465	89,668,185	10·2	1·088	179	113·35	3,594	16/3	·937	1·95	·539	7·48	3,195	213	232
Leicester ...	229,296	3,663,215	32,907,795	8·983	·981	143	95	3,648	11/9	·693	2·18	·984	8	18	107	140
London ...	...	H 1,680,786 E 48,777,026	17,347,746 516,092,489	10·32 10·58	·84 1·04	... ...	83 113	2,646 8,732	... ...	1·019 ·627	... ...	... ...	6·15 8·44	742·5 15,786·8	55 1,179	96 1,584
Newcastle ...	300,000	4,593,419	49,348,688	10·74	1·087	164	...	3,595	14/5	·59	1·58	·633	7	...	...	186
Northampt'n	90,076	652,074	6,497,622	9·95	·98	74·38	...	2,923	5/11	·531	1·34	·7	6·91	...	...	26
Portsmouth	236,732	2,204,042	25,039,320	11·36	1·066	110	84	3,593	9/5	·497	1·66	·62	7	1,086	72	100
Preston ...	120,000	936,553	9,000,070	9·61	1·02	75	130	3,802	6/9	·639	1·01	·95	7·36	380	20	30
Reading ...	75,500	917,045	8,279,650	9·02	·97	109	97	2,505	8/9	·57	1·59	·68	7	352	26	36
Sheffield ...	455,793	7,720,026	90,458,851	11·717	·896	198·465	101·3	4,403	14/10	·522	2·5	·416	7·274	3,018·78	208·192	269
Wellington...	68,000	2,269,840	23,262,433	11·01	1·33	342	93	4,316	42/8	·94	1·287	·76	8·01	786	68	85

E—Electric trolley system. H—Horse lines. (a) Including 8,955 miles coal haulage. (b) 123 cars all day.
(c) Includes tramway operating cost only, excludes cost bulk supply to lighting department.

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FINANCIAL REPORTS AND MEETINGS.

Hong Kong Tramways Company.—The dividend for the year 1912 is to be 7½ per cent.

Preston Tramways Committee have assented to devoting £1,300 from their reserve fund of £37,000 in order to effect a reduction of a penny in the borough rate.

The Tramways and General Works Company have declared a dividend of 16⅔ per cent. (1s. per share), free of income-tax, for the past year, carrying forward £142.

Lima Light, Power, and Tramways Company.—The net profits for 1912 were £(P.)98,890, and an additional dividend of 1¼ per cent. is proposed, carrying forward £(P.)2,026.

Hastings and District Electric Tramways Company.—The directors have declared a final dividend of 3 per cent. on the preference shares, making 6 per cent. for the past year, and carrying forward £3,051.

Potteries Electric Traction Company.—For the year ended December 31 last the directors recommend a dividend at the rate of 5 per cent. per annum on the preference shares, and 3½ per cent. on the ordinary shares.

Auckland Electric Tramways.—The directors of the Auckland Electric Tramways Company have declared an interim dividend of 7½d. per share, free of income tax, on the ordinary shares for the half-year to December 31.

Vera Cruz Electric Power, Light, and Traction Company.—The net profits for 1912 were £16,744, and £1,514 was brought forward. A dividend of 2½ per cent. is proposed, adding £5,000 to the reserve, and carrying forward £4,509.

Bombay Electric Supply and Tramways.—The directors recommend a dividend on the ordinary shares at the rate of 5 per cent. per annum, free of income tax, for the year ended December 31, 1912. The dividend will be paid on July 1.

Bolton Tramways.—The committee have allocated £13,500 of the profits on the tramways undertaking for the relief of the rates, and £16,623 has been placed to the reserve fund, which totals £55,901. A start has been made with the erection of a new generating station, to cost £120,000.

British Electric Traction Dividend.—The directors recommend the payment of the dividend on the 6 per cent. preference stock and 3 per cent. on the 7 per cent. preference stock for the year ended March 31. The full dividend was paid on the 6 per cent. preference stock for 1911-12, but the 7 per cent. stock received nothing.

Colombo Electric Tramways and Lighting Company.—The board have declared a dividend of 10 per cent. for the year 1912, carrying forward £8,422. £15,000 has been transferred to general reserve and renewal fund. For 1911 the dividend was the same: £11,000 was placed to general reserve and renewal fund, and £7,447 was carried forward.

Brisbane Electric Tramways Investment Company.—The net profits for the past year, including £6,574 brought forward, were £82,006. The directors recommend that £5,500 be added to the reserve (bringing that fund up to £10,000), that a final dividend of 4s. per share be paid on the ordinary shares (making 8 per cent. for the 12 months), and that £3,781 be carried forward.

Calcutta Tramways Company.—Mr. E. C. Morgan, who presided at the annual meeting, said that another record had been made in traffic receipts, the increase for the year amounting to nearly £15,000. The divisible balance was £54,028, which enabled them to pay a final dividend of 10 per cent., making 7½ per cent. for the year, and to place £15,000 to reserve, carrying forward £4,626.

Municipal Purchase of Bahia Tramways.—The directors of the Bahia Tramway, Light, and Power Company have issued a circular asking the debenture holders to consent to the sale of the undertaking to the municipality of Bahia. They say the enterprise commenced with every prospect of success, but they have been subject to local hostility and failed to obtain any relief from unjust competition.

A Successful Year at Bury.—The net surplus on the Bury tramways for 1912-13 was £9,572 and on the Radcliffe tramways £1,252. Of the total of £10,824, £6,252 has been contributed to the borough rates, £3,572 to the reserve and depreciation fund, and £1,000 to commence an insurance fund against third-party claims. The total reserve and depreciation fund is £32,571, and insurance fund £1,000, in addition to which £42,877 has been set aside in the sinking fund and loans fund, making a total sum of £67,448.

Plymouth Corporation Tramways. For the year ended March 31 the income amounted to £39,049, compared with £37,913. The expenditure, exclusive of interest and sinking fund charges, reached £28,735, leaving a gross profit of £10,313, against £10,478. After payment of interest and sinking fund charges, a net profit of £2,846 was realised, compared with £3,027. The committee decided to apply £200 of the net profit to meet the cost of alterations at Compton depot, the balance to go in relief of rates.

London County Council Tramways Assessments.—The Finance Committee of Camberwell Council have reported on the application of the County Council to have the gross and rateable values of their tramways reduced from £35,055 to £1 and from £21,349 to £1, in consequence of the falling off in the receipts, due, among other things, to competition from omnibuses. The committee were of opinion that the assessment should be inserted in the June provisional valuation list at a nominal reduction of £1. Any appeal would then be dealt with by the Assessment Committee. The Borough Council adopted this course.

Lisbon Tramways Company.—Mr. L. Breitmeyer, presiding at the meeting of the Lisbon Electric Tramways, Limited, on May 14, said that their business had suffered during the year under review from two strikes, and it had been estimated that the tramway had lost thereby about £20,000. Owing, however, to the satisfactory traffic during the remainder of the year the loss had been for the most part made up, and the net decrease on the year, compared with the previous year, was £7,060. The net profit amounted to £102,745. An interim dividend of 3 per cent. net had been paid, and it was proposed to pay a final dividend at the same rate, making 6 per cent. for the year, and to carry forward £8,637.

Singapore Electric Tramways.—Sir Frank Swettenham presiding at the annual meeting of the Singapore Electric Tramways Company in London on May 13, said that during the year traffic receipts had increased by £1,446, and sales of energy to the Government and municipality by £1,875. Working expenses had risen from £42,613 to £43,916, practically entirely on account of the increased cost of fuel. The profit of £5,358 reduced the adverse balance brought forward to £3,824. While the passengers carried had been increased they had been able to reduce the mileage. The most important event of the past year was the renewal of their contract with the municipality for another 10 years. Sir Charles Petrie seconded the motion for the adoption of the report, which was agreed to.

British Westinghouse Electric Company.—Mr. J. A. Bryce, M.P., presiding at the annual meeting of the British Westinghouse Electric and Manufacturing Company on May 6, said that competition was still very keen in the electrical and allied industries, but the prices obtained last year were slightly better. The gross profit amounted to £157,871, and the net profit to £41,074, and adding the sum brought forward, there was a surplus of £66,899, which it was proposed to carry forward. The company were undoubtedly in a better position owing to the result of their appeal to the House of Lords with regard to their claim against the Underground Electric Railways Company of London. This matter has been referred back to the arbitrator for further consideration. The report was adopted.

Nottingham Tramways Increased Profit.—During the year ended March 31 the Nottingham Corporation Tramway receipts totalled £167,160, and the expenditure £108,274, leaving a balance of £58,886. For 1911-12 the income was £162,597, the expenditure £106,162, and the balance £56,435. Thus the gross profit has increased by some £2,450. The committee propose to contribute £19,000 in aid of the rates (as compared with £18,000), £14,349 goes to interest on consolidated stock and loans, £5,831 contribution to sinking fund for redemption of consolidated stock, £2,008 contribution in lieu of interest on consolidated stock cancelled, £11,923 instalment for repayment of loans, and £4,775 is transferred to reserve and renewals fund. The wages account rose by £1,358.

Hartlepool Tramways First Year as a Municipal Undertaking.—West Hartlepool Council on May 6 received the first financial statement regarding the working of the tramways. The traffic receipts for the seven months during which the tramways had actually been worked by the Corporation were £8,484, or 7·7d. per car-mile. The cost of running was 5·4d per car-mile, a penny less than the average for the country. For five months prior to the Corporation working the tramways, the company from whom they were purchased ran them for the Corporation. On this period there was a loss to the town of £550. After paying this, £21 remained to be carried to the reserve fund on the whole 12 months. The Corporation electricity undertaking showed a gross profit of £6,270. The net balance of £368 was carried to the reserve fund, which totals £5,309. A new waste-heat station is approaching completion.

Birmingham Tramways Grant to the Rates.—In response to an appeal by the Finance Committee the Tramways Committee on May 5 decided to increase their grant in aid of the rates from £46,000 in 1912 to £56,000 in order to make up for a decrease in the sum allocated by the Gas Committee. A very satisfactory statement of accounts on the working of the department during the year ended March 31 was presented. In 1911-12 the number of passengers carried was 113,475,000, whereas in 1912-13 the total rose to 132,510,000. The reduction of fares brought down the receipts per car-mile from 11·04d. to 10·47d., and as the car-mileage last year was 13,134,000 the revision of fares represented a concession to the travelling public of between £70,000 and £80,000. The increase in wages cost about £4,000. The traffic receipts showed a large advance, and when all the accounts were balanced there was a net profit of £101,000.

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TRAMWAY AND OMNIBUS SHARE LIST.

Specially Compiled for "The Tramway and Railway World."

Amount Ranking for Dividend.	Shares.	Name.	Div'd. Prev. Half-year.	Div'd. Last Half-year.	Quotations, May 28.	Movement During May. Rise.	Movement During May. Fall.	Latest Business Done. Price.	Latest Business Done. Date.	Yield on Buying Price. £ s. d.	Dividend Due. (Final in Italics.)	Quotations, Jan., 1908, to May 28, 1913. Highest	Quotations, Jan., 1908, to May 28, 1913. Lowest
640,000	5	Anglo-Argentine Tramways 5½% Cum. 1st Pref.	2/9	2/9	4 13/16—5 1/16	...	...	5 1/32	May 27	5 8 9	Jan., Dec.	5 17/32	4¼
500,000	5	Do. do. 5½% Cum. 2nd Pref.	2/9	2/9	4⅜—4¾	...	...	93/9	May 26	5 15 9	June, *Dec.*	5 11/32	4 1/16
1,500,000£	...	Do. do. 5% Deb. Stock Red.	5%	5%	99—101	...	...	100¼	May 28	5 0 0	June, Dec.	105½	96
325,532£	Stk.	Auckland Elec Trys. Co. 5% Mort. Deb. ..	5%	5%	101—103	...	...	101	May 13	4 18 0	Jan., July.	107	101
75,000	1	Bath Electric Tramways 5% Cum. Pref. ..	6d.	6d.	11/16—13/16	..	...	14/6	Dec. 31	6 3 3	*Jan. & July*	15/16	7/16
334,696£	Stk.	Birmingham Dist. Pow. & Tract. 4½% 1st Deb....	4½%	4½%	88—90	...	..	91½	Dec. 17	5 0 0	Jan., July.	96	77
15,000	10	Blackpool and Fleetwood Tramways	4/-	9/-	13⅞—14⅛	...	...	14	Mar 10	4 12 0	Feb., Aug.	14½	12
60,000	10	Bombay Elec. Supply & Trys Co. 6% Cum. Pref	6/-	6/-	10¾—11½	...	...	10 15/16	May 2	5 4 6	Feb., Aug.	12¼	7⅜
1,003,614	$100	Brazil Traction...	6	6	96—98	+ ½	...	96½	May 27	6 6 6	Fb.My Ag.Nv.	105¼	90¼
75,000	5	Brisbane Elec. Tramways Investment Co. Ord.	4/-	4/-	7⅛—7⅜	...	...	7¼	May 16	5 5 0	*May*, Oct.	9½	3 9/16
75,000	5	Do. do. do. 5% Cum. Pref.	2/6	2/6	4⅞—5¼	...	...	5 1/16	May 2	4 15 3	*May*, Nov.	5⅜	4⅜
50,000	10	Bristol Tramways and Carriage Co.	4	4	5¾—6¼	...	...	5⅝	Nov. 9/10	6 8 0	*Feb.*, Aug.	14¼	5
50,000	10	Do. do. do. 4% Cum. Pref.	4	4	7¼—7½	...	— ⅛	7	Sept. 30	5 6 9	Jan., July.	9¼	6¾
800,000£	Stk.	British Columbia Electric Railway Def. Ord. ..	8%	8%	127—131	...	— 3	129	May 27	6 2 3	May, Nov.	156	123
800,000£	Stk	Do. do. Pref. Ord.	6%	6%	109—113	...	— 4	112	May 24	5 8 3	Feb., Aug.	132½	105
800,000£	Stk	Do. do. 5% Cum. Perp. Pref.	5%	5%	102—105	...	— 1	101½	May 28	4 16 3	Jan., July.	114	99
1,070,097£	Stk.	British Electric Traction Prefd. Ord.	...	...	11—13	+ 2½	...	11¾	May 27	...	Apr., *Oct.*	16	8½
403,503£	Stk.	Do. do. 6% Cum. Pref. ..	6%	6%	85—88	+ 1	...	87	May 27	7 1 3	Feb., *Aug.*	95¼	83
1,464,245£	Stk.	Do. do. 5% Perp. Deb. ...	5%	5%	89—93	+ 1	...	90½	May 22	5 7 6	April, Oct.	101	82½
439,796£	Stk.	Do. do. 4½% 2nd Deb. Red. ...	4½%	4½%	74—78	+ 1	...	74½	May 21	5 15 6	May, Nov.	84	58
246,625£	Stk.	Buenos Aires Port & City Trys. 6% 1st Mt. Deb.	6%	6%	92—96	...	..	93	May 20	6 6 6	Feb., Aug.	103	61
623,270£	Stk.	Buenos Ayres Lacroze Trys. Stg. 5% 1st Mt Deb.	5%	5%	99—101	...	..	100¼	May 28	4 19 0	Mar., Sept.	103	89
137,610	5	Calcutta Tramways Ord.	2/6	5/-	5¾—6¼	+ ¼	..	6	May 14	6 0 0	*Apr.*, Oct.	7¼	4
47,295	5	Do. 5% Cum. Pref.	2/6	2/6	4 13/16—5 1/16	...	..	5 1/16	May 6	4 18 9	Jan., July	5⅜	4⅜
491,222	1	Cape Electric Tramways	1/-	for '12	11/16—13/16	...	...	16/3	May 26	6 3 3	Feb., *Nov.*	13/16	⅛
15,000	10	Carthagena and Herrerias Steam Tramways ...	4/-	May, '12	3¼—4	...	— ¼	75/-	May 6	...	April.	7	3
248,000	5	City of Buenos Ayres Tramways (1904) ...	2/6	2/6	5¼—5½	...	— 1/16	5 5/16	May 28	4 15 3	Fe Mv.Au No	6	5⅛
120,000£	Stk.	Colombo Elec. Trys. & Ltg. 5% 1st Mt. Deb. ...	5%	5%	90½—94½	...	...	96	Jan. 31	5 2 0	May, Nov.	101	87
11,500	10	Cork Electric Tramways and Lighting Co. ...	...	6/- ann.	4¼—4¾xd	...	...	4 15/32	Dec. 23	6 6 6	*Mar.*	10	4¼
12,327	10	Do. do. do. 5% Cum Pref.	5/-	5/-	7½—8	...	..	8	July 22	6 5 0	Jan., July	10¾	7½
3,000	10	Dublin and Lucan Elec. Railway 5% Cum. Pref	5/-	5/-	8½—9	...	.	9	Aug. 25/10	5 11 3	Sep.15, Mar.15	9¼	6
60,000	10	Dublin United Tramways Co. (1896), Ltd., Ord.	6/-	6/-	11¼—11¾	...	...	11 9/16	May 23	5 2 3	Feb., Aug.	14	11
60,000	10	Do. do. do. 6% Cum. Pref.	6/-	6/-	11¾—12¾	..	...	12 1/32	May 28	4 14 3	*Feb.*, Aug.	14	11½
13,500	10	Gateshead & District Trys. Co Ord.	5/-	9/-	8½—9	..	.	8 11/16	Apr. 7	7 15 0	*Mar.*, Sept.	9¼	7⅞
268,235	10/-	Hastings and District Elec. Trys Ord.	...	...	1/32—3/32	...	...	1/9	Jan. 5/12	...	...	1/16	1/32
80,000	1	Do. do. 6% Cum. Pref. ..	6%	6%	⅝—¾	...	...	12/6	June 6	8 0 0	...	⅝	1/32
125,000£	Stk.	Do. do. 4½% Deb. Stk. Red	4½	4½	68—73	+ 1¼	...	73¼	Feb. 8/12	6 3 3	April, Oct.	100	68
$9,634,000	$1,000	Havana Elec. Rly. Co. Con. Mort. 5%	5%	5%	97—101	...	...	97 11/16	Mar. 29	5 2 0	Feb., Aug	105	80
195,000£	100	Hong Kong Tramways Co. 5% Mt. Deb. ...	5%	5%	87—91	...	...	90	May 2	5 11 3	May, Nov.	92	75½
20,000	10	Imperial Tramways Ord.	Nil	Nil	4½—5	...	— ¼	9¾	Oct. 29/09	...	Feb., Aug.	9¾	2¼
20,000	10	Do. 6% Cum. Pref.	Nil	Nil	7½—7¾	...	— ½	6 7/32	Ju. 28/09	...	Jan., July.	9½	2¾
30,000	5	Isle of Thanet Elec. Try. & Ltg. Co. 5% Cum. Pref.	2/6	Dec. '12	2⅛—2⅜	...		46/3	Nov. 30	4 15 3	*Mar.*, Sept.	3	¾
250,000	1	Kalgoorlie Electric Tramways	...	...	1/32—3/32	..	..	1/-	Jan. 15/12	...	*May*	⅜	1/32
170,000	1	La Plata Elec. Trys. Co. 6% Cum. Pref. ...	0/4·65	May, '13	13/32—1 1/32	...	— 1/32	19/6	May 2	...	*April*, Oct.	1 1/16	¼
30,800	10	Lanarkshire Tramways	5/6	6/-	10—10½	+ ½	...	10	May 27	5 9 6	Feb., Aug	10 9/16	9⅜
250,000£	Stk.	Lancashire United Trys. 5% Prior Lien Deb....	5%	5%	78—80	..		78½	Mar. 26	6 6 9	Jan., July.	95	78
634,026	1	Lisbon Electric Tramways Ord.	7½d	7½d.	1⅛—1 5/16	..	...	22/6	May 21	4 11 6	*July.*	1 9/32	⅞
425,553	1	Do. do. 6% Cum. Pref ...	7½d.	7½d.	1 1/16—1 1/16	...	...	22/6	Feb. 15	5 1 3	Jan., July.	1¼	13/16
1,000,000£	Stk.	London General Omnibus 4½% 1st Deb.	...	4½	94½—96½	+ ½	...	95¾	May 26	4 14 9	Jan., July.	98	95¼
1,000,000£	Stk.	Do. do. 5% Cum. Income ...	...	5	83—90	+ ½	...	89½	May 27	5 12 6	Feb., Aug.	94	87½
125,000	10	London United Trys. (1901), Ltd., 5% Cum. Pref.	2/6	Dec. '08	4½—5	...	..	5¼	Dec. 5	...	*Jan.*, July.	8½	1⅜
63,430£	Stk.	Madras Elec. Trys. (1904) Ltd. 5% Deb. Red. ...	5%	5%	103—105	...	...	102¾	Mar. 7	4 16 3	Jan., July.	105	86
300,000£	100	Manaos Trys. & Ltg. Co. 5% 1st Debs.	5%	5%	90—93	+ 2	...	90½	May 22	5 9 3	Jan., July.	97	86
$4,785,000	$1,000	Manila Elec. R. R. and Ltg. Corp. 5% Gld. Bds.	5%	5%	97—100	...	...	99	May 27	5 0 0	Mar., Sept	104⅜	84
60,000	1	Mansfield & District Trys. Ltd. 6% Cum. Pref.	7½d.	7½d.	13/16—1 1/16	...	..	19/3	Sept. 5	5 13 0	Mar., Sept.	1 1/16	¾
578,504	1	Metropolitan Electric Tramways Ord.	5	6	27/32—31/32	...	...	21/3	Dec. 10	5 13 6	*April*, Oct.	1⅜	⅝
500,000	1	Do. do. do. 5% Cum. Pref.	6d.	6d.	11/16—13/16	...	...	14/-	Mar. 13	6 3 3	*Feb.*, Aug.	1 1/32	11/16
$16,487,400	$100	Mexico Tramways Common Stock	$3½	$3½	103—105	...	— 2	106½	May 15	6 17 3	Fb.My.Au No	151½	65
$3,840,000	...	Michigan Untd Rys. Co. 5% 1st Debs & Refdg Bds	5%	5%	93—5	...	— 1½	92¾	May 5	5 8 3	May. Nov.	101½	92¼
600,000£	100	Montreal Street Rly. 4½% Ster. Debs.	4½%	4½%	98—100	...	...	99½	May 20	4 10 0	Fe.My.Au.No.	107	98
150,000	1	National Steam Car	2/-	year	1⅜—1½	...	— ⅛	28/-	May 28	6 13 6	Dec.	39/9	27/6
5,000	10	Oldham, Ashton, and Hyde Elec. Tramways Ord.	5/-	7/-	6⅛—6¾	...	...	7	Apr. 2	9 8 3	Mar., Aug.	9¾	6⅛
5,000	10	Do. do. do. 5% Cum. Pref.	5%	5%	6¾—6⅞	...	...	6 17/32	July 8	7 11 0	Feb., Aug.	8½	6¼
77,893	5	Para Elec. Rly. and Ltg. Co., Ord.	5/-	5/-	6⅞—7⅜	...	— ⅛	6⅞	May 23	6 16 3	May, Nov.	8	6
100,000	1	Perth (W.A.) Electric Tramways Ord.	6d.	7½d.	1 3/32—1 11/32	...	...	25/6	Nov. 8	4 2 9	*Sept.*, Nov.	26/10½	⅜
245,000	1	Potteries Electric Traction Ord.	3½	for '11	5/16—7/16	...	...	7/6	Dec. 2	8 0 0	April.	¾	⅜
245,000	1	Do. do 5% Cum. Pref. ...	6d.	5d.	13/32—17/32	...	..	13/1½	Apr. 30	6 13 6	*Feb.*, Aug.	¼	1/16
124,560	1	Provincial Tramways Ord.	8d.	10d.	11/16—13/16	...	..	16/-	Mar. 28	9 4 3	May. *Nov.*	1 1/16	13/-
10,000	10	Do. do. 6% Cum. Pref.	6/-	6/-	9⅜—9⅞	...	..	9 1/16	Apr. 23	6 4 9	June, *Dec.*	11	9
50,000	5	Rangoon Elec. Trys. & Supply Co. 6% Cum. Pref	3/-	3/-	5⅜—5¼	...		5⅜	Apr. 26	5 2 3	June, Dec.	6	5
32,000	10	Shanghai Elec. Construction Co.	...	...	7¾—8¾	...		8	Nov. 28	...	May.	11½	6
330,400£	Stk.	Singapore Elec. Trys. Ltd., 5% Debs. Red. ..	5%	5%	83½—87½	...	..	85	Apr. 8	5 14 3	Mar., Sept.	89	61
169,570	1	S. Metrop'n Elec. Trys. & Ltg. Co. 6% Cum. Pref	1/2⅜	May. '12	11/16—13/16	...		15/9	May 16, '12	7 7 9	Feb., Aug.	1⅛	⅜
91,720£	Stk.	Southern Elec. Trys. of B.A., 1st Mt. Deb. ...	5%	5%	96—98	...	..	96	Mar. 6	5 3 3	Feb., Aug.	100	90
471,500£	100	Toronto Rly. Co. 1st Mt. 4½% Stg. Bonds ..	4½%	4½%	98—100	...	...	98¼	May 8	4 11 0	Feb., Aug.	104	97
80,000	5	United Elec. Tramways of Monte Video, Ord....	4/-	3/-	5—5⅜	...		5¼	May 2	6 10 3	*June*, Dec.	6½	4⅞
90,000	5	Do. do. do. 6% Cum. Pref.	3/-	3/-	4⅞—5¼	...	— 1/16	5¼	May 2	5 14 3	June, Dec.	6⅜	4 9/16
500,000£	Stk.	Winnipeg Elec. Rly. Co. 4½% Perp. Cons. Debs.	4½%	4½%	99—102	...	...	100⅜	May 14	4 8 3	Apr., Oct.	10 9/16	98½
40,977	5	Yorkshire (West Riding) Elec. Trys. Ord. ...	...	...	¼—¾	...	...	8/6	Oct. 31	...	*Mar.*	1⅛	⅛
46,261	5	Do. do. do. 6% Cum. Pref.	1/6	1/6	3⅜—3⅞	+ ⅛	...	70/-	May 27	3 17 6	*Mar.*	3⅞	1¾

ELECTRIC RAILWAY SHARES.

Amount Ranking for Dividend.	Shares.	Name.	Div'd. Prev. Half-year.	Div'd. Last Half-year.	Quotations, May 28.	Movement During May. Rise.	Movement During May. Fall.	Latest Business Done. Price.	Latest Business Done. Date.	Yield on Buying Price. £ s. d.	Dividend Due. (Final in Italics.)	Quotations, Jan., 1908, to May 28, 1913. Highest	Quotations, Jan., 1908, to May 28, 1913. Lowest
1,854,720£	Stk.	Central London Ord. Stock	3	3	82—84	...	...	83	May 28	4 15 3	*Feb.*, Aug.	89½	59⅞
572,640£	Stk.	Do 4% Pref. Stock	4	4	84—86	...	...	84½	May 22	4 13 0	Feb., Aug.	92	80
572,640£	Stk.	Do. Deferred Stock	2%	for '12	80—82	..	...	80¾	May 27	4 17 9	Feb., Aug.	91⅜	42
78,000	10	Great Northern and City Pref. Ord. 4% ...	Nil	Nil	2¼—2½	...	— ¼	45/-	May 2	...	*Feb.*, Aug.	2¾	⅛
50,000	10	Liverpool Overhead Ord.	2/-	2/6	3⅞—4	+ ⅛	..	78/9	May 22	5 16 3	*Feb.*, Aug.	4	⅜
1,412,263£	Stk.	Mersey Cons. Ord. Stock	Nil	Nil	5¼—5¾		...	5⅝	May 27	...	*Feb.*, Aug.	8	1
5,732,062£	Stk.	Metropolitan Cons.	1½	1¾	50½—51	.	— ¼	50 15/16	May 28	3 3 6	*Feb.*, Aug.	75¼	34
2,640,914£	Stk.	Do. Surplus Lands Stock	2¾	2¾	62—64	...	...	62	May 27	4 6 0	*Feb.*, Aug.	72	60¾
3,235,000£	Stk.	Metropolitan District Ord.	Nil	Nil	37¾—38¼	...	— 1	38⅜	May 26	...	*Feb.*, Aug.	51½	9½
467,000	10	Underground Electric Railways Co. of London	...	...	3⅞—4⅛	...	...	81/3	May 27	..	...	5 1/16	1⅜
1,730,000£	...	Do. 4½% Bonds of 1933	4½%	4½%	97—99	...	...	98	May 28	4 12 0	Jan., July	102	73
1,192,707£	...	Do. 6% 1st Income Debs.	6%	6%	110—112	+ 1	...	110¼	May 26	5 7 3	Mar., Sept.	117¼	109
6,120,750£	...	Do. 6% Income Bonds	40/-	60/-	91—92	...	— ½	91¾	May 28	5 8 9	Mar., Sept.	97½	18

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A Prosperous Year at Bournemouth.—The report on the working of the Corporation tramways during the year ended March 31, presented by the general manager, Mr. Bulfin, gives the receipts as £96,720, an increase of £4,323, which, up to this date, was a record, the receipts per car-mile being 12·33d. in place of 12·022d. The working expenses, exclusive of capital charges, amount to £52,640, being a decrease of some £2,190, and, having regard to mileage run, establishes a record for the system, the percentage of working expenses to receipts working out at 54·83 per cent., as against 59·83 per cent. in the previous year, and the working expenses per car-mile have been reduced from 7·13d. to 6·71d. This large advance in receipts is mainly due to the alteration of the services on the side routes, the revenue being increased by some £900 on a reduced car-mileage of over 4,000, the adoption of the bonus scheme for the best takings on all routes, which has made the staff more keenly alive to intending passengers, and the advantage of two Easters occurring in one financial year.

Sunderland District Electric Tramways, Limited.—The report for the year 1912 states that after providing for interest on the prior lien bonds, the first and second mortgage debentures, and the expenses of the receivership, the accounts show a loss on the past year's working of £1,175, bringing the aggregate loss to date up to £18,065. Since the close of the company's year on October 31, the scheme of arrangement referred to in the last report has been carried into effect, and the board have again assumed the entire management and control. The balance of the money provided under the scheme, together with that handed over by the receiver, is sufficient to provide the new cars required, and to make other needed improvements. Additions and alterations have been made to plant, machinery, and permanent way, which should still further reduce operating expenses. For the 26 weeks of the current financial year, the traffic receipts show an increase of £2,175, and the general position of the undertaking may be regarded as much more satisfactory than it has been for some years past.

London and Suburban Traction Company.—At a meeting of this company, held on May 21, Mr. C. B. Stuart-Wortley presiding, it was decided to increase the capital to £3,600,000 by the creation of 200,000 new preference shares of £1 each, and 150,000 new ordinary shares of £1 each. The chairman stated that the object was to enable the company to acquire a controlling interest in the South Metropolitan Tramways and Lighting Company. The arrangements provided that for each £100 of 6 per cent. preference shares in that company there would be issued £125 cumulative 5 per cent. preference shares, and for every £100 of ordinary shares there would be given £75 of the ordinary shares of the London and Suburban Company. The South Metropolitan operated 13 miles of line between Tooting, Croydon, Penge, and Sutton, and they had also acquired 10 new motor omnibuses. In 1912 the company had £16,000 for distribution, after paying debenture and preference share interest, and putting £3,000 to renewals and £5,000 to reserve. The proposal was carried with one dissentient.

The British Thomson-Houston Company, Limited.—The report of this company for the year ended December 31 last shows that after paying interest on debenture stocks and loans there was a profit of £30,999. Including £7,381 brought from the last account, there is a balance of £38,381, which the directors recommend should be appropriated as follows: Depreciation of plant, etc., £26,696; depreciation of apparatus, supplies, meters, etc., £6,270; writing off special experimental expenses, £1,825; and carrying forward £8,590. The report states that during the year a four-floor building, to be used for railway work and for manufacturing purposes, has been completed. A one-storey building, to be used for the manufacture of heavy apparatus, and another for pattern storage, are in course of erection. Improved methods in the manufacture of "Mazda" lamps have permitted a large increase in the output of the Rugby lamp factory, and as a consequence the Willesden factory, which it was proposed to use for lamps, will be used as a switchboard factory. The company's operations were severely handicapped by the national miners' strike early in 1912. Deliveries of raw material were delayed, and the company's output was thereby considerably restricted.

New General Traction Company.—The directors report that for the eight months ended March 31, 1913, since July 31, 1912, the date of the last balance-sheet, the liabilities have been reduced out of the proceeds of the sale of the Coventry undertaking by the repayment of loans amounting to £40,700, by the redemption of the balance of £68,000 prior lien debentures, and by the repayment of £41,700 of 5 per cent. mortgage debentures, leaving £158,300 5 per cent. debentures still outstanding. The revenue received and accrued from the various sub-companies amounted to £19,013. General expenses amounted to £1,799. The accounts show a profit of £10,288, to which is added £4,689 brought forward, making £14,977 available for distribution. The directors recommend that £10,480 be appropriated to the payment of a 4 per cent. dividend, less income tax, and £4,497 carried forward. The dividend received from the Coventry Company for the year ended December 31, 1912, was 8s. 6d. per share. The Norwich system showed an increase in traffic and a decrease in expenses. A dividend of 3 per cent. was received from that company for the year ended June 30, 1912, as against 2 per cent. for the previous year. The Douglas Southern Electric Tramways, Limited, paid 6 per cent. on their preference shares. The income from the Philadelphia undertaking was in respect of the six months ended December 31, 1912, and amounted to £6,965.

Tramway Construction at Santos.—Presiding at the thirty-second annual meeting of the City of Santos Improvements Company, held in London, Mr. D. M. Fox, referring to the tramway portion of the company's operations, stated that during the year the entire electrification of 38 miles of tramways had been completed. Their thanks were due to their engineers, Messrs. Mordey and Dawbarn, and Mr. Sayers, the resident engineer, for the way in which this work had been completed. He would read an extract from the report of Mr. Browne, their general manager in Santos: "The electrification marks an epoch in the development of Santos, the effects of which are already remarkable. Land values have increased out of all proportion; elegant mansions are being built along the principal routes, and imposing commercial buildings are springing up along the city routes. There is, in fact, a complete transformation of the city coming into being, and the municipality are recognising it by embarking on a large scheme of street widening, reconstruction, and repaving." On the motion of the chairman, £5,000 was placed to reserve, £8,000 to tramways renewal account, £5,282 carried forward, and a dividend of 7½ per cent. declared for the year. Messrs. F. Henderson and H. V. Woollaston were re-elected directors, the first-named being thanked for the incalculable value to the company of his frequent visits to Santos.

Burton Corporation Tramways.—The report of the tramways manager, Mr. A. B. Slater, for the year ended March 31, 1913, shows that the total receipts amounted to £15,687, a decrease of £478, while the traffic revenue per car-mile shows a decrease from 8·07d. to 7·90d. The percentage of operating expenses to revenue is 78·7 compared with 77·75 last year. The decreases are confined to the first two quarters, as in 1911 there was then extra traffic in connection with the coronation and other festivities. The car-miles amounted to 437,106, a decrease of ·87 per cent. Operating expenses show a slight decrease from 6·45d. to 6·41d. per car-mile, notwithstanding the general increase in wages which was granted in March, 1911, and the contributions to national insurance. There is a surplus of income over expenditure of £3,352, representing 3·2 per cent. on the capital expenditure. The repayment of debt and interest charges amount to £2,823, leaving a surplus of £529, which has been carried to the reduction of suspense account. A sum of £1,500 has, however, been placed to the renewals fund, and this has been provided out of the rates. The consumption of electrical energy per car-mile, including the Burton and Ashby Light Railway cars, amounts to 1·06 units, compared with 1·17 last year; excluding the light railway cars, the figures are 1·01 and 1·13 respectively. The consumption during the past three years, since 1910-11, when meters were installed on the cars, has declined by ·26 units per car-mile, the present record being the lowest yet reached. The saving for the year amounted to £295. The bonus system for freedom from accidents and general satisfactory conduct has been in force, and 11 motormen and three conductors have received the maximum bonus of 20s. and 15s. respectively during the year, while seven motormen have been awarded special bonuses for prompt action in averting accidents.

Leeds City Tramways.—The annual report of the general manager, Mr. J. B. Hamilton, issued in the form of a 50-page pamphlet, contains a full account of the year's work, including information relating to routes, stages and fares, diagrams showing mileage run, and a large outline map of the Leeds tramways and connecting lines. The receipts for the year ended March 31, 1913, amounted to £411,531, or 11·229d. per car-mile. This shows an increase of £16,210, or 4·1 per cent. over the previous year. The working expenses amounted to £213,817, an average of 5·834d. per car-mile, leaving a gross profit of £197,713. Including bank interest and dividend on redemption fund investments, there is a total at net revenue account of £205,224. Deducting interest and sinking fund charges (£92,119), income tax (£5,020), rental of Morley Light Railways (£3,216), permanent way renewals (£41,752), contribution towards capital outlay in respect of additional brakes and rotary converters (£1,337), the costs of Acts (£403), there is a net surplus of £61,374, which has been devoted to the relief of rates. An excess of £6,258 in the traffic expenses over the previous year's figures is due to the running of 267,508 more car-miles, and an increase of £3,881 in the wages of motormen and conductors. The total number of passengers carried, 89,668,185, shows an increase of 3,646,242 or 4·23 per cent. The average fare per passenger was 1·088d. The total average working expenses per car-mile were 7·718d. The ratio of working expenses to receipts was 51·95. The Corporation has now 292 electric tramcars, 4 railless cars, and 11 petrol vehicles. The gradual increase in the number of cars and the mileage run, and the necessity of enlarging the car works for the repair and maintenance of the rolling stock, has led the Tramways Committee to take over from the Improvements Committee a large area of land (20,668 square yards) near the centre of the city in Sovereign Street, for the purpose of erecting a central depot capable of accommodating 55 cars. The report states that the risk for third-party compensation is insured with the Ocean Accident and Guarantee Corporation under a policy which amounts to ·124d. per car-mile.

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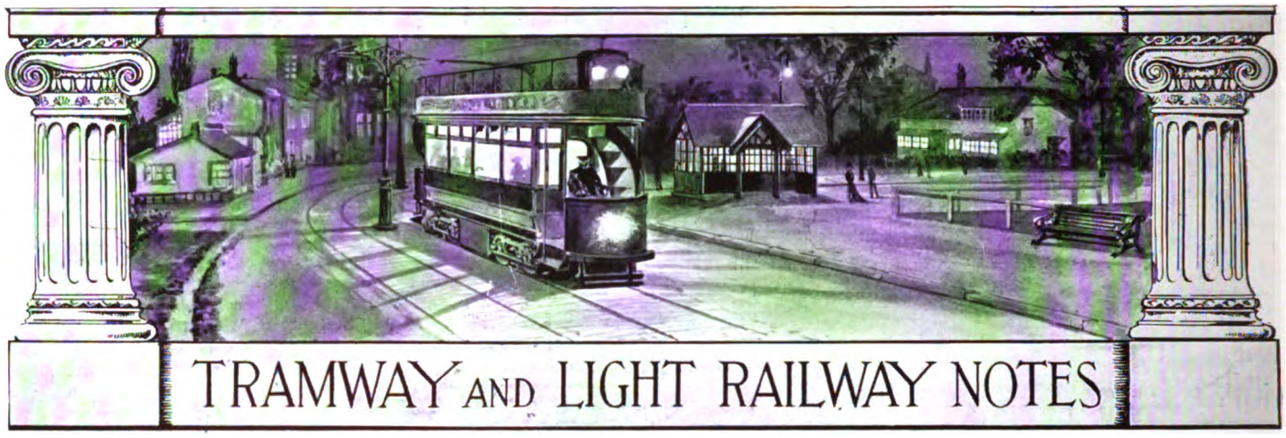

BELFAST.—In moving the adoption of the annual report of the working of Belfast tramways at a meeting of the City Council on May 2, Alderman Finnigan, vice-chairman of the Tramways and Electricity Committee, stated that in the month of June, if he was permitted by the committee, he hoped to bring forward a resolution in favour of adopting a universal penny fare. Last year a proposal to that effect was only defeated by two votes. In Sheffield a universal penny fare had resulted in an increase of £1,200 weekly in the receipts. He did not believe that all the profits of the tramways and of the gas undertaking should go to the relief of rates; the users should get a large share of the profits.

BIRMINGHAM.—The Tramways Committee announced on May 20 that at the July meeting of the Council they will present a report recommending the construction of lines for the purpose of linking up the termini in the city, so as to secure through running.—The Tramways Committee have received a deputation of Hagley Road residents, who urged the adoption of first-class fares when the tramways are opened on that route. Single-deck cars are also asked for. Councillor Harrison Barrow, chairman of the Tramways Committee, states that single-deck cars would not pay at the same fares as those charged on double-deck cars. The proposal for first-class cars would require very careful consideration. In Liverpool the interior of certain cars was reserved for first-class passengers at about double the ordinary fares.

BURY.—Mr. W. Clough, manager of the Corporation Tramways, in his annual report states that to provide the extra number of cars required at the week-ends and, if possible, to avoid the use during the inclement weather of cars which are not fitted with top-deck covers, it has been decided to purchase four additional 56 passenger double-deck, single truck cars, fitted with top covers. These cars will be similar to those already in use with the exception that the staircase and platform have been redesigned so as to allow the ends to be covered in for the better protection of the motormen in case the Corporation eventually decide that this is to be done.

CARDIFF.—As the result of considerable controversy on the question whether the tramway tracks and other places should be relaid with wood paving by direct labour or by letting out to contract, Sir John Courtis, chairman of the Tramways Committee, on May 5, proposed that a deputation visit and make inquiry in other cities and towns as to experiences in a similar class of work. The proposal was agreed to. The estimated cost of carrying out the work by direct labour is £35,000.—Following the recent introduction of the Stevens petrol-electric system installed on London County Council horse cars, Mr. A. Ellis, the tramways engineer and manager for the Cardiff Corporation, proposes to include it with the trackless trolley and the motor omnibus for use in the outlying districts of Cardiff. The Tramways Committee has asked the Parliamentary Committee to schedule these types of vehicles in the bill which is being prepared in connection with the extension of the city boundaries.

EALING.—The local Council have agreed to support the London United Tramways Company in opposing a clause in the London County Council's Bill seeking power to enable the latter body to work, when acquired from the company, such portion of the company's tramways in Hammersmith as the Council had not already powers to work. The company stated they were apprehensive that if this power were unconditionally conferred upon the Council it might result in the cutting of the traffic at the county boundary. The company were opposing the bill with a view to asking Parliament to make the County Council's power to work the tramways—if granted at all—subject to an obligation to maintain the existing through-running facilities.—The London United Tramways Company have also asked Ealing Council to give an extended period of 14 years before the expiration of which the right of purchase by the local authority should not arise. In consideration of this the company would be prepared to relay the rails and such parts of the foundations as might be found to require reconstruction, and to substitute side poles for the present centre poles, as and where required by the Council. Heavier rails (100 lb.) would be laid, and entirely new wood paving, the rails being anchored every 5 ft. The present payment of £500 per annum would continue for the extended period. Consideration of the matter has been deferred.

GLASGOW.—The City Corporation have deferred the consideration of a scheme of superannuation for officials and employees. Mr. Robert Mitchell, who moved approval of the proposal, stated that the Tramways Committee was the only committee which had never had weekly doles to hand out to its servants. That was simply because the tramways staff, with the assistance of the Tramways Committee, had always made provision for their servants, and were doing that work in a regular and methodical way. The Tramways Committee and the Corporation were thus saved a great amount of unnecessary trouble and annoyance. They wished the staffs of all the departments to be placed in a similar position.

HASTINGS.—Mr. George Kitchen, who presided at the annual meeting of the Hastings and District Tramways Company on May 20, stated that although the House of Lords' Committee had rejected the bill seeking powers to substitute the overhead system for the Dolter surface-contact method, the Board of Trade proposed to require the company to cease the use of the Dolter system six months from March 5 last. On May 19 the company's consulting engineer witnessed some trials of the petrol-electric tramcar about to be introduced on a London route. The company's difficulty was to find a system which would enable them to continue the through running between the overhead sections and the Front line tramways to St. Leonards and Bexhill.

KEIGHLEY.—On the recommendation of the Tramways Committee the Town Council, instead of continuing to insure the motor omnibuses against damage and the Corporation against third-party risks, have decided to set apart £200 per annum to be paid into the existing tramway insurance fund. The chairman of the Tramways Committee stated that outside insurance had cost £365 in two years, and only £62 had been received on account of claims. The local tramways insurance fund had been formed through the laying aside of 1s. 6d. per 100 miles run, and the fund now stood at £965.

LIVERPOOL.—On the Walton and Pierhead route, where there is a uniform fare of one penny, an experiment is being made in the collection of the fare when a passenger enters the car. A trial is also being given to the use of route numbers on the cars, the numbers being illuminated at night. Experiments have been made with an automatic point controlling apparatus on the busy lines at the bottom of London Road and opposite to the Town Hall, the object being to ascertain if the system would answer in a busy area.

LONDON.—In presenting the annual estimates to the County Council at the last meeting before the Whitsuntide recess, Mr. R. C. Norman, chairman of the Finance Committee, in a reference to the tramways, said that the estimates of revenue for last year had been entirely upset by omnibus competition, which in its present form and extent was not a year old. But though the results of last year's working had fallen considerably short of their expectations, the revised estimates showed that not only had the working expenses and the interest on the debt been met, but £388,042 had been found out of the surplus earnings for the repayment of capital. Beyond that no appreciable sum was available for the renewals fund. This year rather better results were anticipated, but until some change took place in the conditions now obtaining no material improvement in the financial outlook could be relied upon. As the total loans outstanding on the tramways were about £9,916,000, and the loan charges amounted to £738,000, or the equivalent of nearly a 4d. rate, the future of the undertaking was a matter of much concern to the ratepayers, and no effort must be spared to ensure its financial success. The matter was now under the consideration of the Finance and Highways Committees.—With the consent of both sides, the King's Bench Division on

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May 20 ordered a postponement of the hearing of a motion by the London County Council to set aside the award in the arbitration relative to the purchase of the portion of the Hammersmith section of the London United Tramways which is within the County Council's area. The case involves a very large sum of money.

LUTON.—The new lease between the Town Council and Messrs. Balfour, Beatty and Company, Limited, for the working of the tramways, proposes to extend the period of leasing for a further 10 years, the Corporation retaining power to determine the lease without payment to the company on giving 12 calendar months' notice, to expire at any time.

MANCHESTER.—The Tramways and Electricity Committees have come to the following terms for the supply of electrical energy for tramway purposes: (1) For all current supplied for traction, also for lighting and power, at car sheds and car works, 1d. per unit. This charge is based upon price of coal at 11s. per ton. In the event of increase or decrease in price of coal, there shall be an increase or decrease in the charge for current at the rate of ·02d. per unit in respect of each shilling increase or decrease per ton in the price of coal. (2) This charge shall apply so long as current supplied for traction does not exceed 30,000,000 units per annum. If and when current supplied for traction exceeds this, then the supplies for all purposes (traction, lighting of car sheds, and power at car works) over and above said 30,000,000 units shall be paid for at the prevailing rate which the electricity department charges to large industrial power users under similar conditions of supply. (3) Arrangement to be in force for minimum of three years, and terminable thereafter at end of any financial year on receipt of six months' notice from either side. (4) In event of City Council altering the basis upon which the contributions from the profits of either or both of the two undertakings to the relief of the rates is made, and thereby increasing the total amount of such contributions, either of the two committees to have the option of determining this agreement.—The Tramways Committee propose to extend to another 11 routes the lengthened fare stages, and in some instances reduced fares, which have been in operation for three months on the Cheetham Hill, Oldham, and Rochdale Roads sections. Mr. McElroy, the manager, reports that during the three months the passengers numbered 13,710,673, against 12,039,136 in the corresponding period a year ago. The receipts amounted to £60,610, against £60,276. There may be some diminution of the net earnings, but it will not seriously affect the financial position of the department.—The union employees of the tramways department met on May 24 and decided to submit to the executive council of the union—prior to sending a deputation to the Tramways Committee—demands for the abolition of the bonus system for freedom from accidents and adverse reports; an advance of wages to 35s. a week for drivers and conductors, and a shilling advance for trolley and parcel boys; overtime at the rate of time and a quarter for two hours, and time and a half for all overtime worked over 11 hours per day; 10 days' holiday instead of six; an allowance of 5 per cent. more running time on each route; and one grade for inspectors instead of two.

NORTHAMPTON.—The tramway parcels service is to be developed by the establishment of a central office, which will obviate the delay now arising to cars by the conductors delivering parcels. The conductors will still receive parcels, which will be conveyed to the central offices and delivered by messengers.

PORTSMOUTH.—A number of deputations from other towns have visited Portsmouth to inspect the improved wide setts which have been laid in Goldsmith Avenue. The finely-tooled surface of these setts renders the track as noiseless as possible. The same material is being used on the Twyford Avenue and South Parade Pier to Milton tramway extensions, the rails of which are being welded.

SWANSEA.—In order to inspect tramways working on steep gradients, in view of the recommendation from Mr. S. Sellon to Swansea Council to construct trolley tramways on Mount Pleasant, a deputation from the Council have visited Leeds, Bradford, and Halifax, in company with Mr. Tegetmeier, chairman of Swansea Tramways Company, Mr. D. James, the manager, and Mr. Sellon. The gradient at the steepest part of Mount Pleasant is about one in eight, and in the cities and towns visited similiar gradients were noted. Demonstrations were given at speeds of 20 miles an hour, the cars being pulled up within a few yards. The Spencer brake won general approval, and its adoption is likely to be advocated as removing even the remotest possibility of danger. The Town Council have adopted the Tramways Committee's recommendation to apply to the Light Railways Commissioners for an Order to construct the proposed tramway.

T. Rowlands and Company, Limited, Sheffield, have been appointed European agents for the Titanium Alloy Manufacturing Company, Niagara Falls, New York, whom they have represented in this country for some time past.

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TRAMWAY CONGRESS AT BLACKPOOL.

Over 300 members and guests will attend the annual Congress of the Tramways and Light Railways Association which will be held at Blackpool on June 12 and 13. The head-quarters will be at the Imperial Hydro Hotel. The full programme is appended:

THURSDAY, JUNE 12.

10-30 a.m.—Reception at Imperial Hotel by the Mayor and members of the Corporation of Blackpool, and Boards of Directors of the Blackpool and Fleetwood and Blackpool St. Anne's Companies respectively.

11 a.m.—Papers and discussions:

"Possibilities for Increasing Profits on Interurban Lines," by E. H. Edwardes, A.M.I.E.E., general manager, Lancashire United Tramways Company.

"Tramway Track 1883-1913—A Résumé from a Manufacturer's Standpoint," by Fred Bland, M.I.Mech.E.

1-30 p.m.—Luncheon at Imperial Hotel.

2-30 p.m.—Excursion to Lytham and tea at St. Anne's, provided by the Blackpool, St. Anne's, and Lytham Tramways Company.

7-30 p.m.—Banquet at Imperial Hotel by the Mayor and Corporation of Blackpool.

(Ladies will not be invited to this banquet, but will be entertained at some of the leading amusement places in Blackpool.)

FRIDAY, JUNE 13.

10 a.m.—Papers and discussions:

"Railless Traction and Motor 'Buses," by H. England, general manager, Yorkshire (West Riding) Electric Tramway Company.

"Standard Rules for Motormen and Conductors," by A. V. Mason, general manager, South Metropolitan Electric Tramways and Lighting Company.

12-45 p.m.—Luncheon at Norbreck Hydro.

2 p.m.—Departure for Furness Abbey.

4 p.m.—Tea at Furness Abbey as guests of the Blackpool and Fleetwood Tramroad Company.

8 p.m.—Return to Imperial Hotel.

8-30 p.m.—Members' supper and dance.

Special saloons have been engaged for members leaving Euston by the 2 p.m. express to Scotland on Wednesday, June 11. These special cars will be slipped at Preston, and run through to Blackpool. The special cars will be available for returning to London by the train leaving Blackpool at 7-50 a.m. Monday, June 16, arriving at Euston at 1-40 p.m. Communications relating to the Congress should be addressed to the secretary, Mr. A. de Turckheim, Caxton Building, Westminster, S.W.

PATENT LIST.

Specially abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

*** If the inventions have been communicated the names of the communicators are given below in italics.

APPLICATIONS.

Applications for Letters Patent have been filed:

9,885 Sanding gear for tramway vehicles—E. Bromley.
9,913 Life-guard for motor omnibuses—J. F. Sims.
9,994 Safety guards for motor vehicles—A. H. Bywater.
9,998 Electrically insulated railway joints—W. W. Lewis and T. A. R. Terrell.
10,020 System of electrical traction—F. Stone and F. J. Chapple.
10,039 Railway sleepers—O. E. Wetzer.
10,051 Automatic derailers—M. C. Sloderbeck.
10,063 Railway signalling—R. W. Tarrant and J. C. Sykes.
10,072 Railway sleepers—W. B. Brown and J. L. Stokes.
10,116 Railway chair—P. Hadley.
10,148 Vacuum brake apparatus—H. E. Gresham.
10,164 Flexible electric conductors—Western Electric Company, Limited (*Western Electric Company*).
10,203 Voltage control of electric circuits—British Thomson-Houston Company, Limited (*General Electric Company*).
10,228 Danger signal for tramcars and motor omnibuses—C. Scheck.
10,275 Life-guards for motor omnibuses, etc.—V. E. Harris and C. H. Howe.
10,359 Renewable check rail, either straight or curved, for tramways, light railways, etc.—E. B. Elwell.
10,391 Apparatus for automatically indicating the position of signals on locomotives—M. Manthorpe.

BRITISH FIRMS

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10,404 Apparatus for stopping trains independently of the driver—C. O. Johnson.
10,416 Electric motor control apparatus—A. H. Railing and C. C. Garrard.
10,572 Joint chairs—J. L. Sparling.
10,725 Apparatus and appliances for automatically applying a brake and shutting off motive power at stated speeds—A. Prew.
10,794 Brake mechanism suitable for railway vehicles—G. B. Bowles.
10,803 Electric railway signalling systems—J. B. Mouyen.
10,846 Tram passenger register—E. Priestman and F. Nell.
10,891 Car movers—H. Atkinson.
11,139 Apparatus for ascertaining gradients—W. Glossop
11,160 Section insulators for trolley wires—C. Willis and A. J. Bousfield.
11,260 Superheaters for locomotive boilers—North British Locomotive Company, Limited, and W. Adamson.
11,310 Suspension of overhead wires—Soc. Vedovelli, Priestler, et Cie.
11,337 Automatic coupling gear for railway cars—T. Garankin.
11,353 Car couplers—O. Imray *(National Malleable Castings Company)*.
11,456 Friction brakes—Soc. Anon. des Automobiles Delaunay-Belleville.
11,469 Signalling apparatus—Accumulatoren-Fabrik Akt.-Ges.
11,555 Mud-splash preventer for motor omnibuses—E. McCann.
11,594 Rail joint chairs—M. McHale.
11,608 Life-saving appliances for use on vehicles—E. I. Levensen.
11,628 Train communicating signals—H. A. Robinson.
11,629 and 11,630 Trolleys for electric traction—E. M. Munro and R.E.T. Construction Company, Limited.
11,695 Brake blocks—H. Frood.
11,760 Aerial rope railways and tramways—J. E. S. Darkers.
11,813 Construction and operation of steam superheaters—H. Cruse.
11,839 Prevention of derailment and collision of trains—M. Sandberg and B. Hasenöhrl.
11,847 Welding rail joints—J. Wattmann and the Tudor Accumulator Company, Limited.
11,887 Tickets for use on omnibuses, tramcars, etc.—V. E. Joyce.
11,941 Apparatus for preventing accidents by motor omnibuses, etc.—G. MacElwee.
11,951 Method of supporting and holding down rails—L. Green.
11,994 Railway signalling apparatus—W. L. Rowe.
12,019 Automatic train stop and safeguard—F. G. Travis.
12,065 Electric welding - E. H. Jones.
12,080 Car trucks—W. S. Adams.
12,148 Semaphore signals for railways—C. W. Ward.
12,169 Pendulum attachment for maintaining free the couplings of railway brakes—E. Rennison.

Specifications Published.

1912.

8,811 Railway signalling—Tarrant.
13,801 Conductor rails for electric railways—Merz and Redman.
21,157 Regulators for electric train lighting systems—Kennedy.
24,004 Wheel guard for motor and tramway vehicles—Gooding and Sweeny.
9,088 Rail filing or levelling machines—Caro.
9,622 Automatic car couplers—Willison.
10,805 Supporting of insulators for conductors—Marks *(Reinert)*.
12,858 Pneumatic brakes—Chapsal and Saillot.
13,740 Electric switches for multiple-unit control systems—Turner.
15,023 Electric brakes for tramway vehicles—Turner.
9,416 System of electric generation and transmission for motor-driven vehicles—Leitner.
9,476, 9,477, 9,478 Railway and road passenger vehicles—Huppert, Paul, and Tanner.
9,660 Superheaters for locomotives—Cusack and Morton.
9,784 Apparatus for operating railway and tramway points—Thomson.
11,834 Sectional motor omnibus bodies—E. and H. Hora, Limited.
28,965 Rails—Georgs-Marien-Bergwerkes und Hutten-Verein A.G.
29,890 Railway signalling apparatus—Tyer and Co., Firth and Leake.
16,343 Electric controllers, starting switches, etc., Siemens Brothers Dynamo Works, Limited, and Payne.
17,035 Signalling on railways—Blackall and Jacobs.

1913.

2,089 Railway point-operating apparatus—Stuart.
3,497 Railway rail joints—Moore.
1,725 Lubrication of carriage axles—Carney.
61 Steam superheaters—Hoffmann.

Directories of Electric Tramways and Railways will be found on pages xxv.—xxxiv. of this issue.

TRAFFIC RETURNS.

TRAMWAYS AND OMNIBUSES.

NAME OF COMPANY OR CORPORATION.	1912. WEEKS ENDING.					1913. WEEKS ENDING.					AGGREGATE.		
	May 4.	May 11.	May 18.	May 25.		May 3.	May 10.	May 17.	May 24.		Wks.	1913.	Increase or Decrease.
	£	£	£	£		£	£	£	£			£	£
Aberdeen Corporation	1,313	1,512	1,463	1,492	...	1,434	1,653	1,576	1,586	...	51	76,749	+ 2,633
Ayr Corporation	263	234	130	297	...	257	260	177	299	...	1	397	– 25
Bath Electric	802	811	881	1,222	...	793	767	1,217	952	...	21	16,226	+ 253
Birmingham Corporation	10,186	10,436	10,400	10,818	...	11,355	11,483	12,895	11,138	...	8	89,847	+ 7,178
Blackburn Corporation	1,194	1,091	1,185	1,172	...	1,186	1,215	1,641	1,203	...	8	10,182	+ 714
Blackpool and Fleetwood	629	469	412	473	...	500	440	1,974	803	...	21	9,605	+ 2,062
Blackpool Corporation	1,128	669	636	657	...	970	670	3,365	2,133	...	7½	9,591	+ 3,071
Bolton Corporation	2,417	2,561	2,577	2,577	...	2,600	2,677	3,011	2,756	...	8	21,166	+ 788
Bournemouth Corporation ...	1,664	1,673	1,664	2,344	...	1,767	2,616	2,114	2,052	...	8½	16,509	+ 1,003
Bradford Corporation	5,207	5,391	5,484	5,644	...	5,771	6,149	7,600	5,664	...	8	46,018	+ 1,825
Brighton Corporation	910	926	957	1,018	...	911	1,046	1,211	1,025	...	8	7,535	+ 223
Bristol	6,592	6,290	6,541	7,244	...	7,210	7,328	10,174	7,489	...	21	147,049	+ 16,488
British Elec. Trac. Co's. Undertakings													
Airdrie	289	287	294	304	...	335	337	340	362	...	21	6,561	+ 812
Barnsley	167	169	180	186	...	210	328	470	291	...	21	4,710	+ 1,428
Barrow	350	361	370	429	...	368	373	574	425	...	21	7,465	+ 579
Birmingham and Mid. Joint Com.:													
Birmingham and Midland ...	887	895	926	941	...	956	958	1,374	911	...	21	20,113	+ 1,551
Dudley-Stourbridge	820	837	858	858	...	856	860	1,612	855	...	21	18,391	+ 2,130
South Staffordshire	871	886	908	911	...	993	963	1,471	907	...	21	20,874	+ 2,451
Wolverhampton District ...	460	444	464	468	...	502	500	909	454	...	21	10,565	+ 1,249
Devonport	554	527	533	545	...	496	491	669	503	...	21	10,591	– 80
Gateshead	964	1,016	1,044	1,069	...	1,110	1,205	1,488	1,323	...	21	22,916	+ 2,625
Gravesend and Northfleet ...	193	196	216	214	...	234	224	310	214	...	21	4,460	+ 377
Greenock-Port Glasgow	821	799	852	876	...	834	824	908	879	...	21	16,136	+ 706
Jarrow	133	133	143	141	...	133	151	183	136	...	21	2,749	+ 160
Kidderminster	94	94	97	115	...	93	91	248	104	...	21	2,144	+ 173
Merthyr...	159	179	182	187	...	229	211	285	208	...	21	4,390	+ 773
Metropolitan Electric	8,703	8,751	9,100	8,994	...	9,016	8,983	11,380	9,176	...	21	179,936	+ 4,708
Middleton	338	331	375	359	...	314	329	516	474	...	21	6,774	+ 497
Oldham-Ashton	630	602	641	653	...	603	614	772	665	...	21	12,371	+ 357
Peterborough	122	123	130	132	...	196	181	301	179	...	21	2,889	+ 481
Potteries	1,868	1,929	1,969	1,944	...	2,123	2,119	2,405	1,976	...	21	43,288	+ 6,938
Rothesay	121	122	114	215	...	119	117	159	206	...	21	2,054	+ 267
Sheerness	43	45	47	46	...	47	46	60	48	...	21	976	+ 86
South Metropolitan	841	830	883	875	...	803	795	1,207	856	...	21	15,892	– 281
Southport	287	288	296	288	...	283	266	556	377	...	21	5,732	+ 512
Swansea...	1,029	1,097	1,044	1,106	...	1,209	1,261	1,564	1,232	...	21	24,612	+ 2,628
Taunton	40	41	43	47	...	51	48	79	45	...	21	951	+ 118
Tynemouth	178	195	209	200	...	197	197	444	209	...	21	3,917	+ 516
Weston-super-Mare	81	83	90	101	...	70	75	341	115	...	21	1,403	+ 434
Worcester	253	292	286	294	...	287	272	466	279	...	21	5,573	+ 300
Wrexham and District	125	107	108	111	...	110	112	148	119	...	21	2,351	+ 212
Yorks. (Woollen) District ...	1,044	1,057	1,100	1,110	...	1,120	1,153	1,520	1,081	...	21	23,267	+ 2,145

(Continued on page 438.)

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TRAFFIC RETURNS—Tramways and Omnibuses—*continued.*

NAME OF COMPANY OR CORPORATION.	1912. WEEKS ENDING. May 4.	May 11.	May 18.	May 25.	1913. WEEKS ENDING. May 3.	May 10.	May 17.	May 24.	AGGREGATE. Wks.	1913.	Increase or Decrease.
	£	£	£	£	£	£	£	£		£	£
Burnley Corporation	1,395	1,460	1,474	1,401	1,600	1,642	1,961	1,572	8	13,234	+ 1,359
Burton-on-Trent Corporation	262	269	267	283	295	289	303	271	8	2,210	+ 108
Bury Corporation	1,237	1,318	1,292	1,303	1,350	1,354	1,626	1,408	8	10,704	− 2
Cardiff Corporation	2,174	2,299	2,281	2,379	2,545	2,577	3,132	2,589	8	20,388	+ 3,742
Chatham and District	795	815	853	833	883	849	1,124	839	20	17,213	+ 665
Chesterfield Corporation	207	208	218	221	240	244	350	232	7	1,865	+ 371
Colne and Trawden	246	264	296	284	257	267	367	271	21	5,243	+ 214
Cork Electric	526	529	525	498	482	494	516	493	20	9,298	− 198
Croydon Corporation	1,816	1,777	1,858	...	1,594	1,582	2,127	...	6	10,758	− 1,859
Darlington Corporation	193	221	225	236	250	261	286	240	8	1,949	+ 265
Derby Corporation	793	762	874	941	951	863	1,254	983	8	7,568	+ 1,536
Dover Corporation	204	220	214	230	213	217	294	221	8	1,727	− 51
Dublin and Lucan	146	142	160	143	136	134	161	158	21	2,616	+ 46
Dublin United	5,876	5,841	6,176	5,932	5,862	5,978	6,175	5,896	21	115,127	+ 705
Dundee City	1,123	1,177	1,194	1,187	1,222	1,313	1,255	1,297	1	1,297	+ 110
East Ham Corporation	1,034	1,087	1,064	1,069	1,161	1,099	1,193	1,043	8	8,735	+ 478
Exeter Corporation	306	315	320	315	314	312	428	330	8	2,472	+ 39
Glasgow Corporation	19,174	19,292	19,493	19,766	20,082	20,382	20,672	20,611	51	986,438	+ 19,355
Glossop (Urban Elec. Supply Co.)	127	129	122	120	134	135	156	125	21	2,631	+ 449
Halifax Corporation	1,867	1,938	2,117	1,984	1,904	2,001	3,117	2,007	7	14,851	− 97
Hastings and District	783	780	857	919	886	877	1,284	1,008	21	17,617	+ 1,255
Huddersfield Corporation	1,808	1,913	2,027	1,993	2,062	2,111	2,820	2,036	8	16,596	+ 1,255
Hull Corporation	2,707	2,767	2,782	2,918	3,047	3,103	3,338	2,956	8	23,856	+ 1,520
Ilford U.D. Council	493	524	521	524	459	447	587	453	8	3,597	− 510
Ilkeston Corporation	98	109	116	141	128	167	124	139	8½	1,073	+ 353
Ipswich Corporation	366	423	394	439	417	417	589	419	8	3,295	+ 68
Isle of Thanet	396	449	450	555	450	481	852	556	34	12,253	+ 368
Kilmarnock Corporation	145	159	204	158	164	181	231	173	1	276	+ 4
Lanarkshire	1,421	1,411	1,489	1,460	1,623	1,609	1,740	1,728	20	32,693	+ 4,582
Lancashire United	1,336	1,283	1,371	1,423	1,429	1,419	1,765	1,677	20	28,672	+ 3,055
Leeds City	7,397	7,602	7,850	8,017	8,130	8,290	10,226	8,005	8	64,053	+ 5,848
Leicester Corporation	2,374	2,633	2,589	2,661	2,822	2,790	3,327	2,768	21	56,313	+ 6,302
Leith Corporation	638	702	697	692	650	704	700	736	1	966	+ 52
Liverpool Corporation	11,706	11,725	11,925	12,087	12,644	12,679	13,702	12,579	20½	253,448	+ 14,339
Llandudno and Colwyn Bay	207	198	210	210	227	235	645	373	25	5,197	+ 1,072
London County Council	42,848	42,111	44,752	43,911	42,307	43,399	44,871	40,844	7	306,684	− 12,394
London General Omnibus	50,443	54,916	52,975	54,058	63,117	63,327	73,927	69,216	21	1,214,618	+283,819
London United	6,143	6,222	7,100	6,421	5,901	5,857	9,227	6,786	21	118,281	− 1,750
Lowestoft Corporation	133	127	125	153	149	163	263	186	33	5,410	+ 220
Maidstone Corporation	163	181	190	158	184	188	264	182	8	1,504	+ 102
Manchester Corporation	16,188	16,641	16,781	17,007	17,092	17,350	20,670	17,005	8	136,157	+ 7,354
Nelson Corporation	176	216	203	191	190	194	247	216	8	1,620	− 33
Newcastle-on-Tyne Corporation	4,062	4,201	4,290	4,354	4,696	4,872	4,689	4,507	8	35,667	+ 2,552
Newport (Mon.) Corporation	628	672	672	696	702	713	869	695	8	5,769	+ 605
New St. Helens and District	672	679	723	808	737	750	1,176	769	47	35,164	+ 1,692
Northampton Corporation	501	592	539	525	542	581	783	533	7½	4,286	+ 188
Nottingham Corporation	2,987	3,005	3,161	3,116	3,265	3,285	4,059	3,139	7½	24,694	+ 1,075
Oldham Corporation	1,979	2,115	2,049	2,118	2,134	2,224	2,295	2,174	9	18,819	+ 295
Portsmouth Corporation	2,001	1,978	1,922	2,018	1,908	1,941	2,522	2,104	8	15,605	− 760
Preston Corporation	734	771	779	773	849	842	1,140	758	8	6,903	+ 710
Provincial	1,607	1,675	1,762	1,787	1,688	1,700	2,535	1,789	33½	56,530	+ 3,055
Reading Corporation	501	635	630	613	654	647	806	636	8	4,897	+ 317
Rochdale Corporation	1,456	1,589	1,532	1,500	1,528	1,618	1,989	1,562	8	12,309	+ 199
Rotherham Corporation	665	708	706	892	932	1,303	941	961	8	7,950	+ 2,241
Salford Corporation	4,757	5,048	4,983	5,777	5,018	5,351	6,603	5,056	8	41,617	+ 1,369
Sheffield Corporation	6,282	6,730	6,783	6,897	7,475	7,657	8,180	7,292	9	63,898	+ 8,226
Southampton Corporation	1,203	1,197	1,215	1,148	1,206	1,190	1,464	1,279	7	8,998	+ 230
Southend-on-Sea Corporation	598	620	678	672	720	747	1,169	797	8	5,534	+ 462
South Shields Corporation	566	602	616	625	676	706	793	668	8	5,199	+ 755
Sunderland Corporation	1,139	1,260	1,240	1,303	1,401	1,411	1,482	1,373	8	10,610	+ 1,175
Swindon Corporation	134	141	153	152	158	145	186	159	7½	1,135	+ 102
Tramways (M.E.T.) Omnibus Co.	...	...	...	...	2,935	2,990	4,689	4,134	21	34,470	—
Tyneside Tramways and Tramroads	434	457	491	475	467	520	590	475	21	9,823	+ 569
Wallasey Corporation	998	1,033	1,039	1,062	1,170	1,151	1,576	1,168	7½	9,108	+ 692
Walsall Corporation	532	558	559	597	626	644	849	578	21	12,724	+ 1,293
Walthamstow U.D. Council	705	775	769	768	697	710	1,063	761	8	5,789	− 146
Warrington Corporation	403	404	424	426	461	455	472	441	8	3,309	+ 243
West Ham Corporation	2,651	2,678	2,806	2,752	2,791	2,702	3,202	2,689	7½	20,458	+ 136
Wigan Corporation	1,247	1,264	1,300	1,429	1,434	1,501	1,806	1,427	7½	10,883	+ 1,529
Wolverhampton Corporation	936	964	973	1,563	1,041	1,636	983	1,057	9	9,022	+ 356
Yorkshire (West Riding)	1,204	1,458	1,222	1,329	1,664	1,483	2,047	1,428	21	29,388	+ 3,780
FOREIGN TRAMWAYS.											
Anglo-Argentine	53,561	51,302	50,335	51,016	52,834	58,781	57,156	58,260	21	1,175,286	+ 92,667
Auckland (28 days)	...	18,764	...	...	...	21,662	...	...	45	220,973	+ 30,165
Bombay	3,114	...	...	...	3,221	...	...	...	18	55,709	+ 2,002
Brazilian Street (month) Mlrs.	43,628	...	...	...	44,765	...	...	...	39	402,427	+ 5,282
Brazilian Traction	77,570	80,868	81,099	80,054	88,807	94,144	92,712	92,377	21	1,890,529	+282,858
Brisbane (month)	20,680	...	...	...	25,390	...	...	...	17	99,430	+ 36,196
British Columbia (month) $	476,058	...	...	...	...	...	...	...	—	—	—
Buenos Aires Port and City (month)	...	...	...	...	...	...	...	...	—	—	—
Buenos Ayres Lacroze (month)	42,830	..	...	...	44,316	...	...	...	43	440,193	+ 39,413
Calcutta Rs.	59,808	60,140	54,142	54,822	62,382	62,256	60,060	62,174	21	13,46,202	+ 60,327
Cape Town (month)	11,771	...	...	...	12,175	...	...	...	17	51,462	+ 3,148
Carthagena and Herrerias (month)	915	...	...	...	3,050	...	...	...	17	13,122	+ 6,524
East India (Simplex petrol) (month)	1,610	...	...	...	1,760	...	...	...	39	16,522	+ 2,458
Kalgoorlie (month)	3,084	..	...	...	3,073	...	...	...	17	11,313	− 723
Lima (month)	31,657	...	...	...	32,890	...	...	...	17	134,767	+ 6,133
Madras Rs.	...	(2 weeks)	27,751	...	...	(2 weeks)	27,206	...	19	2,39,926	+ 16,168
Melbourne (month)	60,000	...	...	...	65,500	...	...	...	17	262,000	+ 10,000
Mexico (month) $	551,712	...	...	...	583,558	...	...	...	17	2,080,965	− 72,269
Montevideo (month)	28,034	...	...	...	30,087	...	...	...	26	199,762	+ 14,400
Para	4,029	4,098	4,253	4,014	4,030	4,275	4,050	3,992	25	103,241	+ 4,187
Perth (W.A.)	1,931	1,803	1,935	1,875	2,074	2,036	2,067	1,984	21	43,740	+ 4,375
Port Elizabeth (month)	3,420	...	...	...	4,357	...	...	...	17	16,388	+ 1,312
Shanghai $	19,744	21,171	...	20,043	18,800	23,800	...	22,400	—	—	—
Singapore $	10,467	11,193	10,138	9,755	11,580	12,718	12,458	11,971	21	242,612	+ 23,480
Toronto (month) $	658,174	...	...	...	...	...	...	...	—	—	—
Winnipeg (month) $	292,037	...	...	...	...	...	...	...	—	—	—
ELECTRIC RAILWAYS.											
Central London	4,501	4,251	4,304	4,267	5,147	5,119	4,388	4,663	21	109,686	+ 11,678
City and South London	2,968	2,912	2,997	2,939	2,743	2,667	2,612	2,447	21	61,510	− 5,265
Great Northern and City	1,582	1,534	1,551	1,504	1,401	1,352	1,291	1,310	21	30,740	− 4,095
Liverpool Overhead	1,571	1,547	1,609	1,607	1,677	1,714	1,982	1,659	21	33,886	+ 2,243
London Electric	13,760	13,305	13,545	13,365	14,270	14,030	13,760	13,105	21	302,670	+ 4,860
Mersey	2,027	2,153	1,989	2,058	2,159	2,350	2,308	2,157	21	47,329	+ 3,289
Metropolitan	16,359	16,257	16,462	17,548	16,745	16,695	17,318	17,068	21	344,948	+ 4,865
Metropolitan District	12,405	12,316	12,498	12,737	12,984	13,100	13,103	12,954	21	276,295	+ 13,088

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:: :: **E.C.C.** :: ::

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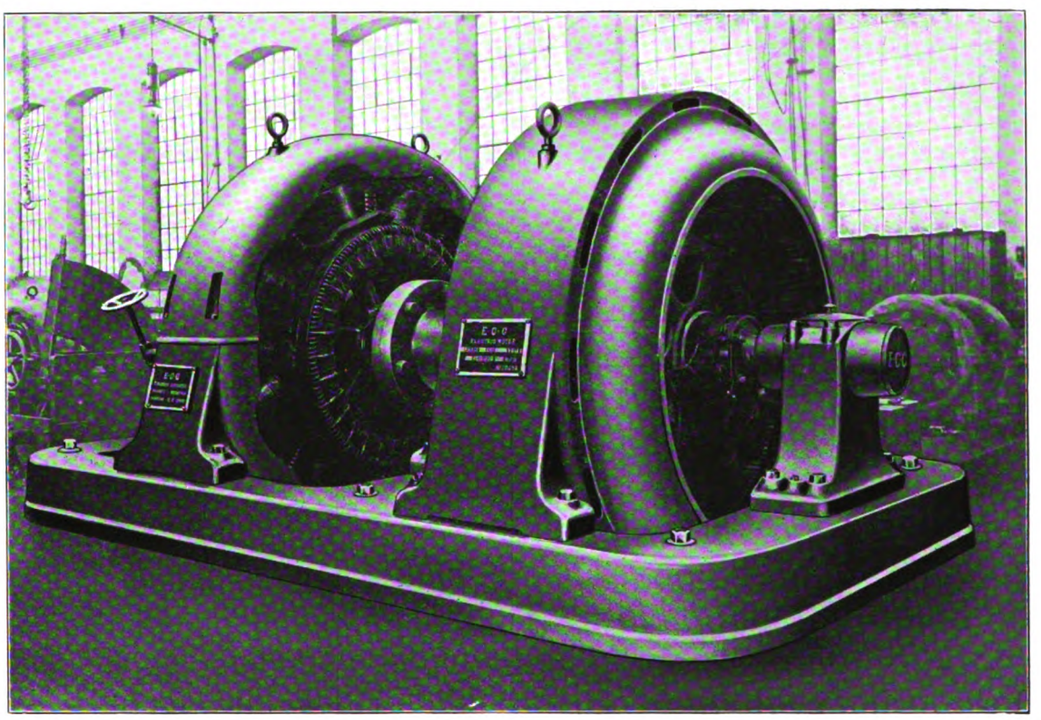

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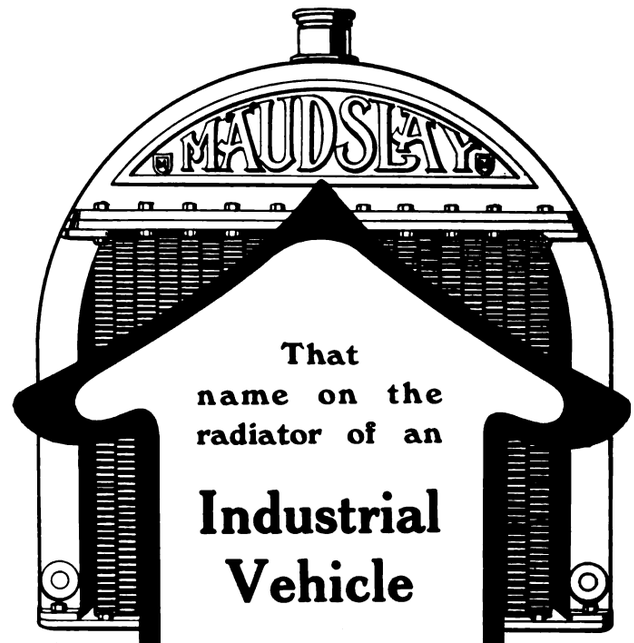

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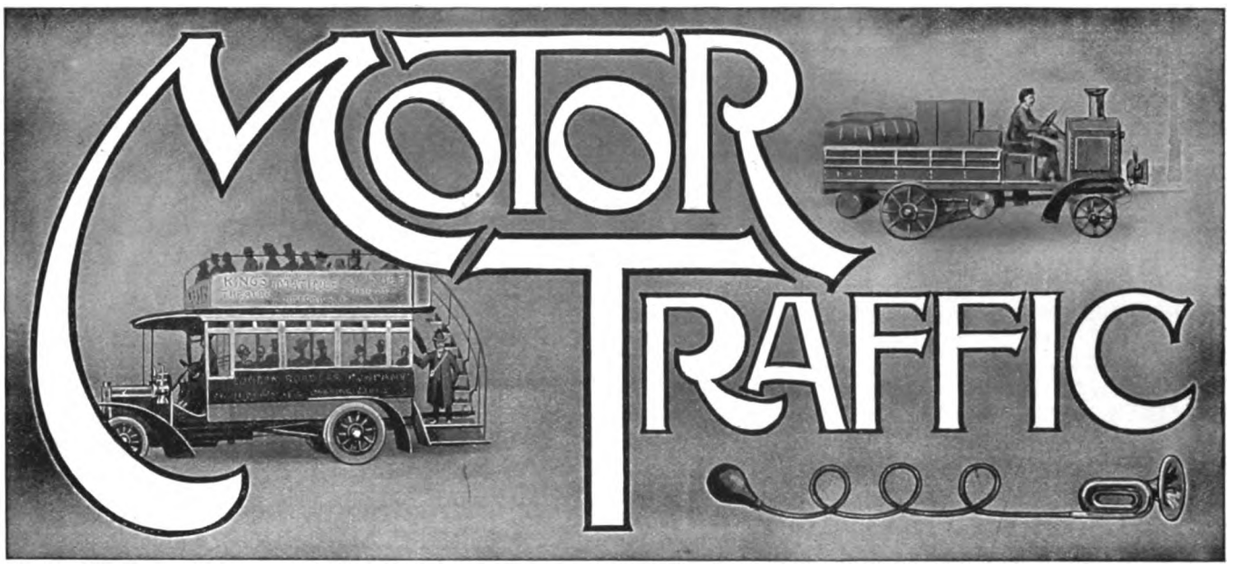

Three events which affect the welfare of motor passenger and commercial vehicles are to take place in London during the present month and in July. From June 23 to 27 the International Road Congress will be held for the first time in this country. The Congress is a creation of recent years on the part of the pleasure motor car organisations of various countries, and at past meetings held on the Continent it has been attended by a fair number of British representatives, including officials delegated by the Board of Trade and the Local Government Board. The present meetings are likely to prove the most important of any yet held, and for this result thanks are due to the Government, acting through the Road Board, and to Mr. Rees Jeffreys, who has discharged the duties of hon. secretary. While yet secretary to the Motor Union, Mr. Jeffreys displayed the warmest interest of any of the officials of the motor organisations in the Congress, but his appointment three years ago to the newly-created Road Board gave him a scope for organisation which has borne excellent fruit in connection with the Congress. Not many of the chief local authorities will fail to send their delegates, who no doubt will greatly outnumber the representatives of motor institutions. Although surveyors have now mastered the problem of constructing road surfaces to withstand for a reasonable period the traffic of the pleasure car, provided the Councils are willing to expend a sufficient sum to secure the contingent grant from the Road Board, they are now faced by the greater task of providing roads capable of sustaining the traffic of the delivery van, the goods wagon, and the motor omnibus. It is upon these matters that the greatest interest will concentrate, and the programme pays adequate regard to their importance. A feature of the present Congress will be the number of engineers who will read papers as representatives of authorities in the United States, whose interest in the proceedings was secured by the hon. secretary on the occasion of a visit which he paid to America last autumn. Visits of inspection to stretches of roads constructed of various materials have been arranged, and there will be an exhibition of road-making machinery and materials.

For July there are two London fixtures which will interest makers and users of heavy motor vehicles in all parts of the Empire. Added importance attaches to the revival of the Industrial Motor Exhibition at Olympia from July 18 to 26 by reason of the arrangement for the Imperial Motor Transport Conference to be held in the third and fourth weeks of the month. This assembly is a new one in automobilism, and it has been warmly supported by the Royal Automobile Club and by the Colonial Office. The credit for originating it is due apparently to Mr. H. Wyatt, the editor of the leading commercial motor journal, who is acting as one of the hon. secretaries. In July visitors from overseas are most numerous, and as in their respective countries the commercial vehicle has not attained such wide use as in Great Britain the holding of the two fixtures concurrently should afford our manufacturers opportunities for bringing their machines to the notice of many prospective purchasers. Visitors who accept invitations to inspect the factories of the manufacturers will find the work of constructing British industrial vehicles at the height of its prosperity, which is likely to be maintained for a number of years. The number of makers is limited, for a special experience extending over some years is necessary to enable satisfactory vehicles to be turned out. This accounts for the circumstance that none but large firms enter the business, which must be made a specialised one. So important a company as John I. Thornycroft, Limited, have recently recognised this at the new works which they have established at Basingstoke, and they have worked to such good purpose that their 3-ton vehicles have not only qualified for the War Office subsidy, but have secured an order from the Army Council for nearly 20 such vehicles. This subsidy scheme should be made to play a more important part in the commercial motor development than it has taken during the year it has been in existence. For some reason the number of makers submitting vehicles for trial has been very limited. Now that the Dominions and Colonies have taken up the question of military defence the scheme should prove useful to their Governments and traders, and in consideration of the vehicles being available for military service the authorities might be asked to revoke the duties placed upon these articles when ordinarily imported. Mention of the duties raises the interesting question of the amount of the taxation which the Canadian Autobus Company will pay on the large number of vehicles they are ordering from the London General Omnibus Company. This aspect of overseas trade will doubtless be alluded to during the discussion by the Motor Transport Conference on the problem of imperial

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MOTOR TRAFFIC.

military motor transport, with special reference to the production of types of vehicles useful both for military and industrial work.

Favourable indeed is the outlook for the heavy motor conveyance. The trade received accessions of business as the result of the strikes of railway and coal workers, and it has not overtaken all the orders which have been placed as the consequence of those events. Now there is promise of further business owing to the raising of railway rates for goods carriage in order to make good the increases of wages granted by the conciliation boards as the price for the settlement of the first strike. All kinds of trades are talking of turning to motor transport, with its lessened handling of freights as compared with carriage by railway. While a good many individual firms may place orders for motor vehicles as the outcome of the discussion, the opportunity is particularly favourable to motor transport undertakings already in existence. Attention is to be paid by the Imperial Motor Transport Conference to the question of motor transport systems for the carriage of goods, their value to the mercantile life of the community, and the adaptation of existing methods of delivery required to enable traders to take full advantage of the capabilities of mechanically-propelled vehicles. Five other questions are also down for consideration, and as the proceedings are to extend over the greater part of two weeks something like adequate treatment should be accorded them. The various matters, however, are of such magnitude, and of so much importance to the Empire's welfare, that some nucleus of an organisation should be maintained in order that annual deliberations may be engaged in with the aid of the Crown Agents for the Dominions and Colonies.

During the last year or two the existence of motor omnibus services has been made a frequent excuse for local authorities to apply to the London County Council, urging that authority to make application to the Local Government Board for reduced speed limits, but the Public Control Committee on nearly every occasion have reported against such a course. The latest instance relates to the suburban locality of Streatham High Road, where three omnibus services have been instituted since the Council fruitlessly applied for a 10-mile speed limit. Again the committee have advised against the application, and any impartial observer acquainted with the locality will recognise that it is so congested that omnibuses cannot attain the speed which the local tradesmen's association desire to see adopted. In all their recommendations against reduced speed limits the Public Control Committee rightly place stress upon the fact that in every ordinary case the police evidence will be against any reduction. Their attitude is well grounded, for slower speed entails congestion. This ground for opposition was well brought out by Supt. Bassom in the evidence which he gave at an inquiry into an application for a 10-mile limit at Hyde Park Corner and several converging thoroughfares, from which 15 services of motor omnibuses meet. It is chiefly on account of the speed of private cars and motor cabs that the reduced limit was sought. The police made out a good case against an alteration of the 20-mile limit for these vehicles, for they were able to show that in the days when horse traffic was the rule a block could be seen over so long a distance as from Albert Gate to Piccadilly Circus. Although there are many more vehicles on the road, the higher speed eliminates congestion. A statement was made that Hyde Park Corner is the busiest traffic centre in the world. The statement may be questioned, and it is of interest to observe that in an interview an official has since limited the statement to London traffic. For this information the public are indebted to the census which the Traffic Branch of the Board of Trade compile from time to time, in pursuance of their restricted duty of gathering information on London traffic placed upon them by the Government, in lieu of carrying out the formation of a London Traffic Board, as recommended by the Royal Commission. These reports will prove valuable to the Board when formed, as everyone connected with London traffic is hoping it will be, after the House of Commons Committee on Motor Traffic have presented their report. Meanwhile the Board of Trade Traffic Branch would discharge an important service by gathering information concerning a statement made by a member of the Committee that the density of population in Glasgow, Liverpool, Manchester, and Birmingham is between three and four times greater than that of London, while in Berlin it is almost six times more.

Though the risk is not great, all forms of public conveyance are liable to an outbreak of fire. The railway train, which is illuminated by gas or uses gas for cookery purposes in the restaurant cars, has been known to be partly or wholly consumed as the result of a conflagration following a collision. No such disaster has occurred in this country to a tramcar, though slight fires are not unknown. While private motor cars have been destroyed by fire caused by the ignition of petrol owing to an upset, motor omnibuses have fortunately escaped these accidents. It will be to the advantage of the several forms of locomotion if means are forthcoming for rendering the vehicles fireproof. At one time or other preparations have been put forward for effecting that purpose, and one method of the kind is adopted in connection with the woodwork of such carriages of the London Underground Railways as are not constructed wholly of metal. The builders of the various forms of conveyance, both rail and railless, will be interested to hear of an announcement recently made by Messrs. Whipp Brothers and Todd, of Manchester. These gentlemen have decided to offer to the nation the valuable patent rights under which wood or cloth of various kinds can be rendered proof against burning. The only requirement necessary to accomplish this is the machinery for the application of the formula. This much Mr. E. Whipp announced during an interview with a newspaper representative, but nothing was said as to the cost of the machinery. Messrs. Whipp and Todd's work is best known in connection with rendering flannelette uninflammable, consequent on the many fatalities among children. The firm are manufacturers of that material, and some years ago they considered whether they should give up the manufacture or try and find a safe process. Dr. Perkins, of Manchester University, was commissioned to make experiments, and after a long period of research he discovered the process. The chemicals used are, Mr. Whipp states, quite harmless.

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MOTOR TRAFFIC.

LONDON GENERAL OMNIBUS COMPANY'S SYSTEM.

The development of the motor omnibus in London has been so rapid and its hold on public favour so secure that all concerned in transport problems everywhere must be interested in the progress and working of the great undertaking of the London General Omnibus Company. By the courtesy of Mr. Walter J. Iden, the company's chief engineer, a representative of this journal recently had an opportunity of inspecting their works at Walthamstow, and of learning some particulars of the manufacture and running of the now famous B type chassis, together with the equipment and management of this exceptionally well-organised factory. The motor omnibus of to-day is the outcome of some years of strenuous labour on the part of the manufacturers and of those responsible for the running and maintenance of the vehicles. As will be gathered from the following account of the visit, the present satisfactory position of the principal company operating motor omnibuses is largely due to the combination of interests, so that the experience gained in working could be used to the fullest advantage on the manufacturing side, thus enabling the company to evolve a standard type of omnibus and to establish a complete organisation by which the maximum efficiency can be obtained.

The London General Omnibus Company was founded in Paris in 1855, and commenced working in London in 1858, the average number of omnibuses at that time being about 450. In the following year it was registered as a limited liability company in England. The record receipts under horse omnibus conditions was in 1862, when, with an average of 602 vehicles on the road, 42,768,248 passengers were carried at an average fare of 3¾d.

The largest horse fleet was attained in 1905, when 1,418 were working. The other important horse omnibus company was the London Road Car, which was constituted in 1880, and reached its maximum fleet in 1904, with an average of 464 omnibuses. Its greatest traffic was in 1903, when 73,134,260 passengers were carried, the gross receipts being £405,597. During this horse omnibus period several small companies were constituted, and it was found necessary to form associations of owners in order to prevent unnecessary competition. The London General Omnibus Company took an active part in the formation of these associations, the influence of which had a far-reaching effect upon London's street traffic.

The year 1906 saw a break in the company's prosperity, chiefly owing to the introduction of motor omnibuses, and to the rapid developments of the underground system of railways. The first motor vehicle was licensed by the police in 1897, but there is no evidence of this having been run in regular service on the streets, the first regular conveyance being a steam car run in Bayswater Road in 1902 by the London Road Car Company, who definitely adopted the substitution of motor for horse vehicles. In 1905, the Vanguard Company was formed, and was followed in 1906 by the Great Eastern Motor Omnibus Company, both these companies running wholly motor services. The London General first ran motor vehicles in public service in 1904.

On July 1, 1908, after some negotiations, an amalgamation was carried through by the Vanguard, Road Car, and London General Companies, the name of the last being adopted for the company.

View in Willesden Garage.

(Accommodation for 200 omnibuses is provided here.)

The number of omnibuses belonging to the London General Omnibus Company, Vanguard, and Road Car Companies, preceding amalgamation, was as follows:

	Horse.	Motor.	Total.
London General Omnibus Company	991	243	1,234
Road Car	222	195	417
Vanguard	—	242	242

The Great Eastern Company was taken over by the London General on January 1, 1911, and on October 25 in the same year the last horse omnibus run by the company was withdrawn.

A REVIEW OF CONSTRUCTIONAL IMPROVEMENTS.

Since the introduction of motor omnibuses no fewer than 32 types have been used by the London General and the Associated Companies. The earlier types were purchased from outside makers, and chiefly from abroad. Of these types, two were petrol-electric, three steam, and 24 petrol omnibuses. From the very beginning it has been the case of the survival of the fittest. The present designs embody only

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MOTOR TRAFFIC.

the good points of the earlier ones, with other details and improvements which have been found desirable in working.

The revised police regulations of August, 1909, when the maximum weight was reduced from 5 tons to 3 tons 10 cwt., and the standard of silence was raised, had a marked and far-reaching effect on the design of motor omnibuses, as it was quite impossible to comply with the regulations unless very much higher-grade material was used in their manufacture. The first chasses to be built under the new regulations were a batch of 60 "X" type built by the London General, which were followed by the "B" type, of which over 2,500 are now running; it may be said that on this latter model all recent designs have been based. It is due to their successful operation that the company has been raised from a non-paying state to a highly prosperous one. The effect of this on commercial vehicles generally should be noted, for the fact that these vehicles proved highly efficient, economical, and reliable did much to promote the substitution of motor for horse transport in all trades.

At the present time 3,220 omnibuses are being operated in London, of which 2,990 are petrol, 100 are petrol-electric, and 130 are steam. The present day omnibus does not differ essentially from the earlier ones in general outline, but in detail it has been greatly improved, and in place of the noisy, inefficient, and unreliable vehicle of the early days we now have a quiet, efficient, and reliable machine, which is a highly creditable example of modern engineering design. The principal alterations that have taken place in design have led to reduction in both weight and noise. The first vehicle had steel tyres, but solid rubber was soon adopted, and has now become the standard. The final drive used to be by noisy toothed gear or by roller chains, which were afterwards altered to inverted-tooth silent ones. At the present about 90 per cent. of the omnibuses are worm-driven; ball bearings have been substituted for plain ones, and automatic lubrication has taken the place of a driver's oil pump fitted on the dashboard. Leaky honeycomb radiators have given way to tubular ones, and thermo-syphon cooling has largely replaced pump circulation.

Taking in Petrol at Willesden Garage.

DEVELOPMENT OF THE SERVICES.

With increased facilities of travel the local journeys per head of population by railway, tramway, and omnibus have increased from 145 in 1903 to 238 in 1912, as the following figures show:

Year.	Passenger Journeys.	Population.	Journeys per Head.
1903	972,465,682	6,710,272	145
1904	1,019,417,803	6,775,645	150
1905	1,073,662,230	6,841,651	157
1906	1,129,784,965	6,908,298	163
1907	1,275,979,458	6,975,593	183
1908	1,375,675,429	7,043,540	195
1909	1,408,883,518	7,112,145	198
1910	1,566,277,272	7,181,415	218
1911	1,658,947,013	7,251,358	229
1912	1,742,219,367	7,318,353	238

The figures also seem to point to the fact that there is a preference for open-air travel, as motor omnibuses and tramway cars in 1912 carried 75 per cent. of London's passengers (including railway passengers), whereas in 1903 only 70 per cent. availed themselves of this means of transport. Again, while the average number of motor omnibuses in daily service has risen 120 per cent. between 1910 and 1912, the number of passengers has increased by 112 per cent., the passenger receipts by 66 per cent., and the route miles by 84 per cent. These figures go to show that the increase in the number of omnibuses is justified by public requirements, that fares have been decreased, and that by lengthening the route-mileage the travelling facilities have been improved.

The increase in the miles of roadway used show that the new conveyances have not been concentrated on the central area, but that the field of operations has been extended (in many cases into non-paying districts) in order that suburban residents may benefit, and also in the hope of developing these districts.

It is pleasing to note that the amalgamation of motor omnibus companies under one control has had a tendency to prevent congestion. It was found that the small companies placed all their vehicles on thickly-populated streets in the centre of London where they paid best, and did not do their fair share towards the development of traffic and benefiting the public generally. The result was unnecessary competition and frequency of service at the expense of other districts, as well as the annoyance of delay at stopping points, touting for traffic, and racing, all tending to cause danger and inconvenience.

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MOTOR TRAFFIC.

SPECIFICATION OF THE CHASSIS.

A motor omnibus chassis is essentially different from a lorry chassis of the same loading, chiefly for the following reasons:

1.—The frequent stopping, starting, gear changing, etc.

2.—Its field of operations is usually in congested traffic, requiring quick and easy control.

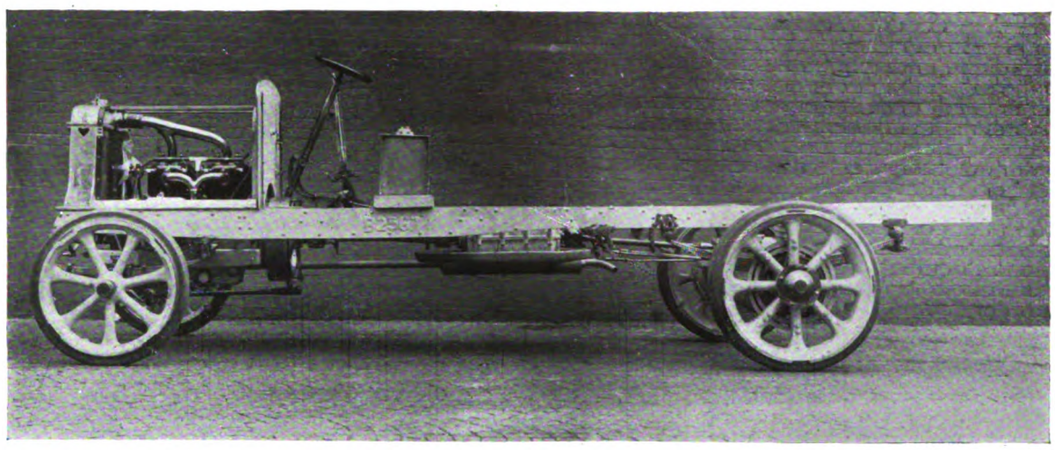
3.—It is a passenger-carrying vehicle, therefore it must run smoothly and quietly, and, as it is used in congested areas, should cause as little annoyance and inconvenience as possible to other users of the road. The chief differences in construction are: The power is slightly higher than for a lorry (about 35 H.P.) to allow for acceleration, and, owing to the need of frequent acceleration, the throttle control ought to be by foot only. It is necessary that the driver's control should be as simple as possible; fittings on the dashboard being done away with as far as practicable in order not to distract the driver's attention. The suspension should be carefully designed so as to give easy riding, while taking into consideration the great variation in load between one passenger and 34. The frame should be strong but springy to reduce harsh shocks. A smooth-acting clutch should be fitted to prevent excessive shock to passengers, its operation being as easy as possible in consideration of its frequent use by the driver. Efficient brakes are necessary, and long-wearing shoes. The frequent stopping and starting of the vehicle with the consequent acceleration of the engine necessitate a very efficient system of cooling, and a plain tube radiator, which can be easily repaired or leaks stopped in it, is essential. All parts should be designed to give extremely quiet running, and accessibility and interchangeability are the most important items to be taken into consideration to allow of an efficient service being maintained. Accessibility is required so that adjustments may be made if necessary on the road without stopping the omnibus for any length of time, and so interfering with traffic; and interchangeability is necessary in order that a damaged part may be quickly replaced by a sound one. The materials used throughout should be of the highest possible quality, as in this way only can the weight be kept within the police regulations, and a thoroughly strong and efficient vehicle be made.

For quietness, a worm drive is considered to be practically essential, and at the present time about 90 per cent. of the vehicles in service are so driven. That all these points have been considered in the design of the London General Omnibus Company's "B" type will be seen from the following specification:

Engine.—110 × 140 millimetres, developing at normal speed, *i.e.*, 750 revolutions per minute, about 30 H.P.

Cylinders.—Cast in pairs with valves on opposite sides.

Lubrication by gear pump to troughs beneath the big ends.



The Latest "B" Type Chassis.

Solex carburettor.

Bosch high-tension magneto and thermo-syphon cooling by large diameter water pipes, connected to a plain tubular radiator of large cooling surface with a belt-driven fan immediately behind it.

Clutch.—Large leather-faced cone type, simply designed and easily adjusted or removed.

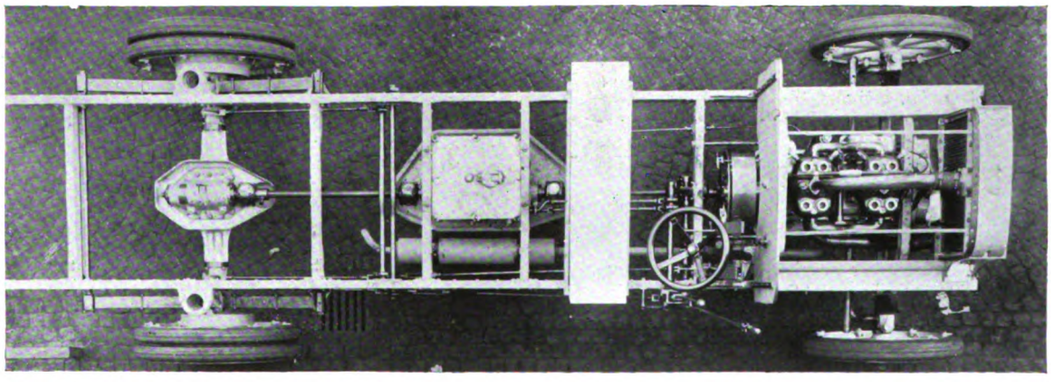
Gear Box.—3-speed chain-drive type, giving speeds of 3·84, 6·65, and 11·98 miles per hour at 750 revolutions of the engine. Reverse, 3·91 miles per hour.

Rear axle.—Worm drive with bevel differential, the complete gear being supported from the top cover of the axle, and capable of being disconnected entirely without removing the road wheels, by withdrawing the axle shaft.

Brakes.—Two separate internal expanding ones, operated by hand and foot on separate drums on the rear road wheels, no braking strains being transmitted through the driving gear, suitable compensating device being fitted.

Steering on the Ackerman principle, operated by worm and nut.

Frame of armoured wood made up of solid ash with nickel steel flitch plates of a depth to suit the varying load.



Plan of Chassis.

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MOTOR TRAFFIC.

Cross members of similar construction, except the engine cross members, which are of pressed steel; both engine and gear box are supported direct from the cross members.

Wheels are of cast steel and run on floating bushes of phosphor bronze.

Springs are of sufficient length to give easy riding; they are semi-elliptic, and have their leaves interlocked.

Tyres.—Front wheels 900 by 120 mm.; rear wheels 1,000 by 100 mm. (twin).

Wheel base.—12 ft. 10⅝ in. or 14 ft.

Wheel track.—5 ft. 8 in.

Width of frame.—3 ft. 6½ in.

Overall length.—19 ft. 2¼ in.

Width over hub caps, 6 ft. 8¾ in.

Although the first "B" chassis was only licensed in October, 1910, improvements are constantly being made, as found necessary in running, or as thought desirable for the improvement of the chassis. A few such alterations which have been made in this way are:

1.—The oil trays round the engine and gear box, which are required by the police, have been cast with the crank case and gear box, instead of being separate sheet metal ones.

2.—The road wheels, which in early omnibuses were of wood, have been made of cast steel, first with plain spokes, then with "Y" shape spokes, and now with hollow spokes.

3. Solid cardan shafts have been substituted for tubular ones

4.—The projection of the hubs from the wheels and consequent overhang on the kerb has been reduced.

5.—The frame brackets and other similar parts have been made of drop forgings instead of castings, in order to reduce their weight and increase their strength.

6.—The pistons have been made lighter in order to give better balance and a more evenly running engine.

7.—The cylinders have been redesigned with large water jackets.

8. Spring-loaded steering rod ends have been substituted for the plain type, in order to reduce noise and make them more reliable.

9.—The second speed chain in the gear box has been altered from ⅝ in. pitch to ¾ in. pitch, as these have been found to be more reliable.

10.—The rear axle tubes have had a sleeve shrunk on the end, which is recessed into the spring carrier, making a much stronger job.

11.—Volute springs are being fitted on the centres of the rear road springs to act as buffers and relieve the road springs of excessive shock, as well as preventing swaying.

Many of these improvements have been considered of sufficient importance to be standardised, and all vehicles have been brought up to date in these respects.

TRAINING OF DRIVERS AND MAINTENANCE OF VEHICLES.

In order that the operation of omnibuses may be efficient and reliable, a well-considered system is necessary in the garages, and that adopted by the London General Omnibus Company may be considered as being as near perfection as is possible. It is the result of running vehicles for a long period under varying conditions. The care of the omnibuses in service largely depends on the drivers, and their choice and training is of great importance. In selecting applicants reference is made to their previous employment, and the drivers of heavy vans in London are found to be the best. The particulars required of a driver's previous work and character are of a very stringent nature. The training consists of two parts, each given concurrently. The novice goes with other learners on an omnibus in charge of an instructor, and practises driving, after being shown how to do so by the instructor. At first more open roads are used, but, later, the main streets are gone through.

At the head office, Grosvenor Road, there is an instruction room, where stripped chasses are kept, and the drivers are taught how an omnibus works, and the principal causes of breakdowns, as well as the means employed to rectify them. When considered fit a driver is sent up to Scotland Yard, and must be passed by the police before he is allowed to go into service.

The omnibuses are maintained and inspected in three ways, viz.:

1.—The driver has 20 minutes allotted before commencing duty in which he must thoroughly inspect his vehicle, and again at night he must repeat this before leaving. Any faults he may find must be entered up in the drivers' report book, and should he find any difficulty in explaining what is wrong he must interview the foreman on duty. The night foreman continually refers to this book and all defects reported are rectified by the night staff. The fitters on this staff specialise: for instance, there are "brake fitters," "steering-gear fitters," "engine fitters," etc. All repairs are initialled on the form by the fitter carrying them through.

2.—About every ten days each omnibus is taken off the streets and thoroughly overhauled. The wheels are removed, gear box and back axle opened up, and the engine is stripped; any parts requiring adjustment or repair are seen to and the driver's reports since the last dock-day, having been entered on a dock overhaul sheet, are looked up, the parts mentioned receiving special attention.

3.—Once a year the chassis is taken off the streets for a fortnight. The body is removed and sent to the coach factory for a thorough overhaul and repainting, whilst the chassis is taken completely apart and inspected in every detail.

In addition to this are the police inspections; the cars may be inspected at any time in the garage by a public carriage inspector, who may also carry out a surprise inspection on any omnibus on the streets. It must not be considered that such inspections are contrary to the company's wishes, as these scrutinies are of extreme value. If considered necessary the officers issue stop notices to the proprietor to prevent the use of defective omnibuses in the streets. These notices are of two kinds: (1) to prevent vehicles running until they have been inspected and repassed by the police, (2) a two days' stop requiring the defects to be remedied within two days. If carried out within two days, there is no need for reinspection. When received from the police stop notices are sent from the head office to the garage with a form calling for a report on the matter.

On January 31 the company were operating 2,550 licensed omnibuses, of which 2,181 were in service, the difference being withheld for overhaul and repair. The following table gives the number of conveyances in service each year since 1897:

Year.	Motor Omnibuses.	Horse Omnibuses.
1897	1	3,199
1898	—	3,423
1899	5	3,626
1900	4	3,681
1901	10	3,736
1902	33	3,667
1903	14	3,623
1904	31	3,551
1905	241	3,484
1906	783	2,964
1907	1,205	2,557
1908	1,133	2,155
1909	1,180	1,771
1910	1,200	1,103
1911	1,962	786
1912	2,550	376

These were run from 31 garages, two of which were just opened and without a full complement of machines, and two were provisional ones of small size. The largest garage housed 200, the smallest 15, the normal being from 80 to 120. The garages as far as possible are situated on the outskirts of London, so that they may be near the terminal points of the routes so as to run no more dead mileage than is necessary. Each garage is under a superintendent, having under him a general foreman, a night foreman, a drivers' foreman, and a washers' foreman, as well as a full staff of clerks, storekeepers, fitters, etc. Each garage carries out its own repairs, and depends on the main factory for new parts.

To promote friendly competition among the garages as far as petrol consumption and running costs are concerned, figures are published weekly of these matters. In case of a breakdown on the road, the driver is allowed a certain time in which to locate the fault and rectify it. Should he not be able to do so, he must immediately telephone to his garage, whence either instructions are given or assistance sent out to him. To prevent careless driving or other negligence a special staff is employed who supervise the running, and report cases of drivers turning corners carelessly, of their failing to stop when hailed, and of any other offences.

PROGRESS OF THE CONSTRUCTION WORKS.

From a very small beginning in 1906 the company's works at Walthamstow have grown enormously, until to-day it is one of the largest and best-equipped factories in the whole of the motor industry. The organisation has, moreover, been brought to such a pitch that the maximum output can always be relied upon, while the passing of bad workmanship is practically impossible. It was in August, 1906, that the Vanguard Company decided to start works of their own, and the building which was the nucleus of the present factory was opened in January, 1907, and equipped with a few machines. During the building of this shop a machine was installed in a hired building, six men being employed in running it. The original Vanguard building, 120 ft. by 270 ft., was sufficiently large to accommodate all the departments, viz., machine shop, chassis shop, tinsmiths', the engine shop, stores, etc. In January, 1908, the Motor Construction Company went into liquidation, and their building was taken over by the

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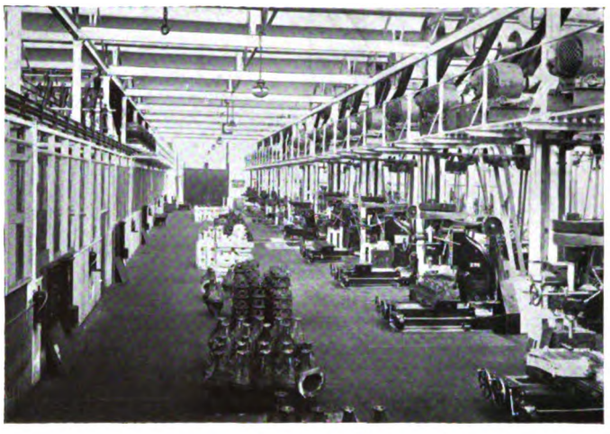
Boring Machine in New Machine Shop.



New Machine Shop, Showing a Gallery of Motors.

The Foundry.

Erecting Shop.

A Corner of the Stores.

The View Room.

VIEWS IN THE WALTHAMSTOW SHOPS OF THE LONDON GENERAL OMNIBUS COMPANY.

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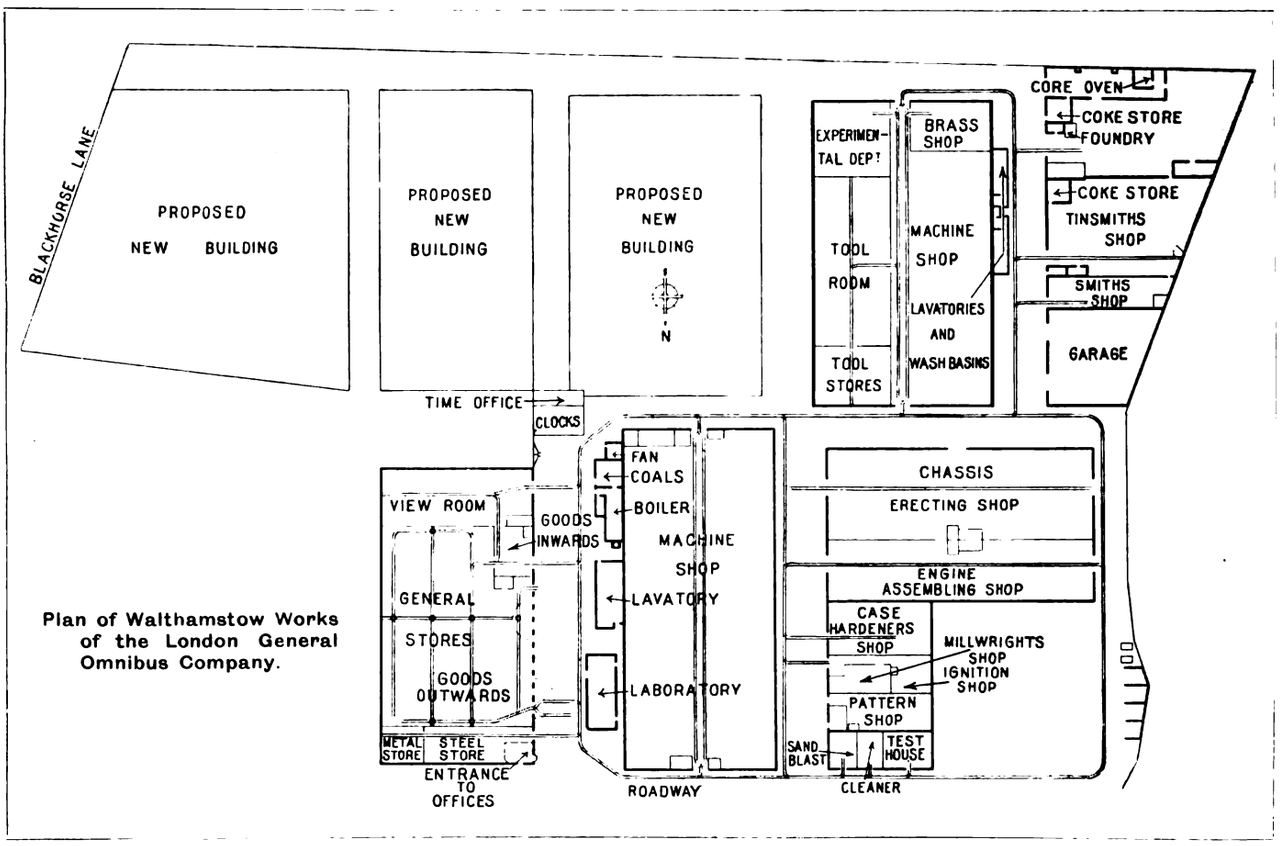
MOTOR TRAFFIC.

Vanguard Company for body-work, bringing the total area of the works up to 61,580 sq. ft., standing on 4·105 acres of ground, in which state it was taken over by the London General Omnibus Company.

The growth and progress of the company's works is shown in the following table:

	Number of Men.	Area Occupied: Sq. Ft.
Oct., 1906	6	In a borrowed shed
Jan., 1907	36	3,000
June, 1907	407	3,415
June, 1908	573	61,580
Jan., 1909	461	"
June, 1909	430	"
Jan., 1910	509	71,740
June, 1910	492	"
Jan., 1911	911	"
June, 1911	1,164	95,570
Jan., 1912	1,256	"
June, 1912	1,552	126,785
Jan., 1913	1,250	155,026

Part of the Week's Output.



Plan of Walthamstow Works of the London General Omnibus Company.

Leaving for the Body Works.

The increased area in 1912 will be noted. On this date the adjoining field of 5·645 acres was required. At the present moment the company has a factory of 155,025 sq. ft., standing on 9·75 acres of ground.

The present position of the Associated Equipment Company, as the Walthamstow works are now known, has been brought about by the development of the present standard "B" type chassis. The works, as we have shown, have developed from a repair shop for the maintenance of a fleet of 200 omnibuses to a factory capable of maintaining a fleet of 4,000 omnibuses, and building 1,500 cars a year. It is the largest and best equipped commercial car factory in the country; capable of turning out anything up to 50 chassis per week. Within the last two years as many as 2,600 chassis of this type have been put on the streets of London. These chassis are used for private hire purposes, both chars-a-bancs and omnibuses, also for lorries, vans, etc.

The wages roll started at £9 per week on October 11, 1906; went up to £50 per week in January, 1907, and in July, 1912, it averaged just under £3,000.

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THE BUILDING OF OMNIBUS CHASSIS.

In June, 1909, the company commenced to build their own chassis, and during the year 60 were built, known as the "X" type. They afterwards designed the present "B" type chassis, and started manufacturing it. The first output was in October, 1910, which amounted to 15 during that month; this was increased to 28 during November, and 33 in December, and the six months, from January to June, averaged as follow per week: 1911, January to June, 11·367; July to December, 19·7. 1912, January to June, 25·367; July to December, 30.

The first of these chassis was turned out with great difficulty, owing to the lack of space, but by the middle of 1911 there was a new erecting and engine shop built of sufficient area to turn out 30 chassis per week comfortably. The shop used as an erecting shop was then turned into an extra stores room. At the end of 1911 a laboratory was started, but this was not completed until 1912. At the same time extensive offices were built.

The works are situated in Black Horse Lane, Walthamstow, within four minutes' walk of the Midland Railway Station (of the same name) and 15 minutes' walk of the Great Eastern Railway (St. James Street), and at the present time consist of five blocks of buildings with all the necessary departments to manufacture chassis from the raw material, namely, machine shop, erecting and engine shops, case-hardeners, pattern and test houses, extensive tool room, foundry, etc., with stores of sufficient accommodation to carry material for the maintenance of 4,000 cars, the stores stock being based on an estimated two months' maximum.

All the yard and roadways between the buildings are laid with Durax granite setts, and the shops are separated by broad roadways, rendering all parts of the factory easily accessible. The average width of the roads is 40 ft.

The works throughout are lighted by electricity, and the motive power is supplied by means of electric motors. The current for this is obtained from the Walthamstow Council, being 460 volt pressure direct current for power and 240 volt pressure for the lighting circuit. The company have recently had new mains laid and new switchboards fitted at a cost of £1,000.

Some idea of the rapid growth of the works will be gathered from the fact that the motor power required in 1908 was 1-50 H.P. and 1-20 H.P. To-day the power required is 80-20 H.P. motors. As a result of this rapid increase of current consumption extreme difficulty was experienced in maintaining the supply during the winter of 1911 and 1912, the Walthamstow Council not being prepared to meet the extraordinary demand. However, owing to the untiring efforts on the part of Mr. G. Spurr, the Council's electrical engineer, the supply was maintained.

The factory is lighted with radiant lanterns, each one being fitted with 4-50 or 100-C.P. metal filament lamps, this being the cheapest and most efficient system of lighting for the purpose.

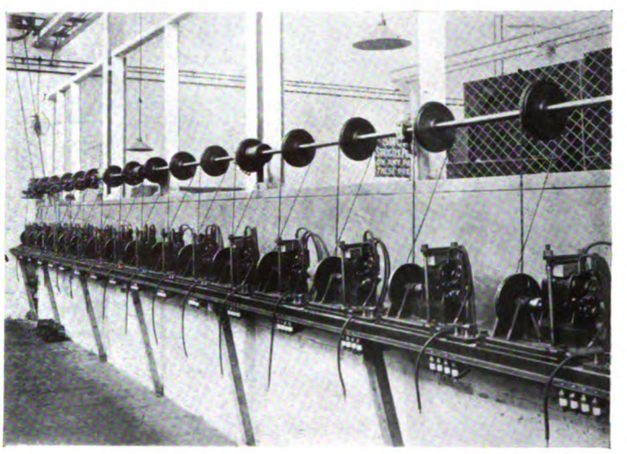
THE DISTRIBUTION OF STORES.

With an undertaking of this magnitude much depends upon the perfection of the stores system. Briefly, the system which has gradually been evolved is as follows: A sufficient stock is carried in the stores at Walthamstow to run all the fleet for at least one month, with a maximum of two months, that is to say, the stores are worked on the automatic principle of fixing maximum and minimum stocks, and when the stores clerk, whose duty it is to file the cards, finds he has reached the minimum, he requisitions for the maximum stock.

When a new part is created, it is the duty of the drawing office to notify the card department (which is a section of the stores) to requisition whatever quantity they may think necessary; this depends solely upon the job which they have received instructions to carry out. The card department then immediately file a card under the part number allotted, and from that date until the part is definitely superseded, it is the card clerk's duty to see that his stock is never below one month, and that his maximum stock is always kept up to the equivalent of the previous two months' consumption. By this means a supply to any depot of any current material for which they may ask, is always to be ensured at a minute's notice.

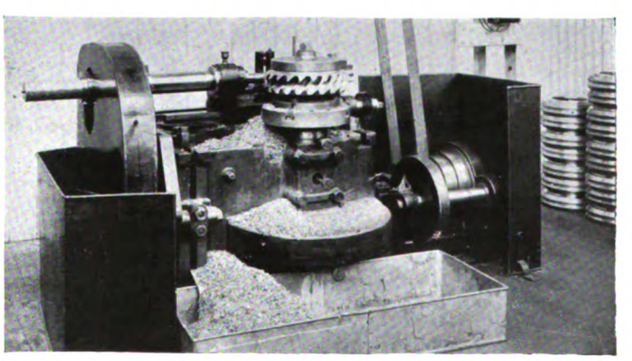
The depot storekeeper makes out his requisitions as he goes through his cards and sends them through to the works three times a week. The requisitions which arrive on Monday are dealt with by the stores on Tuesday, that is to say, all the particulars asked for are made ready and placed in a fixture allocated to the particular depot, and a proper delivery note and invoice are made out to accompany the goods. On Wednesday morning these goods are loaded upon a lorry and delivered to the depot, when the depot storekeeper signs the delivery note as having received the same in good condition and places them in the proper fixtures provided for them at the depot. This operation is repeated three times every week. The average number of different items supplied to the combined depots per day is 900 to 1,000. For this purpose, a special fleet of lorries is kept which delivers all this material and collects any parts to be returned to the factory.

The basis of all this system is, firstly, the standardisation of parts, which means that if 10 chassis which were built two years ago, and 10 chassis built to-day, were disassembled and the parts mixed up together, it will be found that they can be assembled without regard to which chassis the parts have been removed from. Every part on the chassis is accurately finished to the limits laid down, which limits



Testing of Magnetos.

are held to be as close if not the closest of any motor manufacturers in this country. Any alteration which promises to effect a vast improvement, and be economical in the cost of maintenance and running is immediately adopted throughout the fleet. By this means the oldest "B" type chassis in existence is as up-to date as the last one built. The second essential is the adoption of "Kalamazoo" blue print binders and standard part numbers for every part. When a chassis is built, drawings are made of each individual item, which are drawn out upon part sheets and numbered from one upwards. These blue prints are bound in binders and a binder sent to each depot running these cars, also to the purchasing department. For



Cutting the Worm Wheels.

any alterations or modifications revised blue prints are furnished to the depots, so that at all times their "Kalamazoos" are up to date. Thirdly, the depot stores are a reproduction in miniature of the main stores. All the bins bear the same part numbers, and are worked in exactly the same way, viz., maximum and minimum stocks.

It will be readily understood that the standard "B" type omnibus did not arrive at its present stage of development without a considerable amount of experimental work as well as very extensive laboratory research. As soon as it was decided to build omnibuses on a large scale one of the first steps taken was to provide and equip an up-to-date laboratory, in order to carry out both the physical and chemical tests

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MOTOR TRAFFIC.

of all classes of steel, metal, petrol, oil, etc., and from the results obtained in this way much of the success is due. Systematic tests are always made upon the higher grade materials delivered. The *minimum* specification for the steel used for the most highly stressed shafts is 110 tons tensile with an elongation of 12 per cent.

Every batch of this class of material that comes through is tested so as to keep up to this standard.

From this department came the development which is daily coming more into general use, *i.e.*, the heat treatment of alloy steels. It is worthy of mention here that all the steel used in the manufacture of parts which take any strain are all heat-treated in one way or another, for which purpose special furnaces, which are controlled by pyrometers, special oil baths, etc., have been installed.

From: LABORATORY. *26th May, 1913.*
To: WORKS MANAGER.

REPORT OF TENSILE TESTS ON STEEL.

Tensile Ref. No.	Analysis Ref. No.	Description of Material and Condition of Treatment.	Mark on Piece.	Elastic Limit. Tons per sq. in.	Maximum Stress. Tons per sq. in.	Elongation per cent. on 2 in.	Reduction of Area per cent.	Brinell Tests. Diameter of Depression.	Brinell Tests. Hardness No.
		Mild steel as rolled	M.S.	19·80	2[illegible]·88	41·0	69·74	—	—
		High duty nickel chrome steel, air hardened	—	95·76	110·48	13·5	34·88	—	—

Another section which depends to a large extent on the laboratory is the alloying of metals and the production of suitable alloys for the different purposes for which the metal may be used.

The alloy from which the worm wheels are made and from which such excellent results are obtained was only arrived at after considerable experiments.

Stores Wagons Leaving the Works.

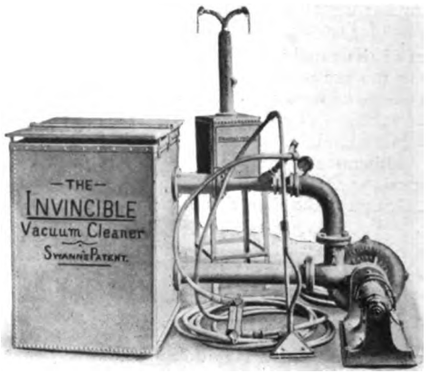
The view room is situated in the stores buildings, and all parts which are delivered here either in their rough or finished stage from outside have to pass the inspectors before they are taken into stock. This also applies to all material which goes through the machine shops. Not only are these parts viewed for each operation, but they are stamped by the viewers, each one being supplied with a certain trade mark stamp of his own, and when the parts are finally passed for machining they bear a letter which signifies the date, month, and year in which they were made, a mark which indicates the class of steel from which they are manufactured, and a part number, as well as a type letter which is affixed to show the class of chassis on which it is to be used. If the part is of high-grade steel it also has to carry a hardness test, etc. By this data it has been possible to get very reliable figures as to what material gives the best results, and under what conditions.

It is obvious that in order to maintain the high state of efficiency which now prevails throughout this huge undertaking that a highly-trained and competent staff is necessary. In this respect there can be no question that the organisation is most complete, and that in Mr. G. Schave, the late works manager, who is now chief assistant to Mr. Iden, and the present works manager, Mr. John O'Neill, the chief engineer has most able and painstaking assistants.

PAYMENT ON ENTRY AT LEEDS.—After an experimental working of the payment of fares at entry *en route* on one of the sections of the Leeds tramways, the Tramways Committee have recommended that the system should be extended to every route.

THE "INVINCIBLE" VACUUM CLEANER.

The primitive method of cleaning the interior of public carriages which has obtained in the past has been alike unsatisfactory to the officials responsible for the work and the travelling public. Hitherto the difficulty of obtaining reliable machinery appears to have prevented the general adoption of mechanical appliances for this important duty, as with the low vacuum obtainable with the air-pump machines the work has been far from satisfactory and has resulted in mere surface cleaning. We have recently had an opportunity of inspecting the "Invincible" vacuum cleaner, which works on an entirely different principle and appears to be a very great advance upon the earlier types of machines. Many clever brains have been devoted to the task of evolving the perfect cleaning machine, and it would certainly seem that the greatest advance in this direction has been accomplished by the developments covered by the Swann patents which, it is claimed, have enabled the "Invincible" system to give a sustained vacuum of 30 in. at the end of 300 ft. of flexible hose. An important feature in the "Invincible" cleaner is the fact that two, three, four, or even more separate hose can work simultaneously with 30 in. vacuum on each and every hose, and this from the same machine.



The principle of this system is hydraulic; by means of water pressure the vacuum is maintained and regulated at will. Moreover, two distinct methods of operation are provided, so that should the dry dust method of cleaning fail to work, either by accident or carelessness on the part of the operator, the extracting apparatus can immediately be connected to the water tank and the work can be continued without loss of time, while the repairs are being carried out. In order to prevent the pump from becoming choked when this method of cleaning is in operation, a revolving, perforated screen is provided, which divides the water tank into two compartments. This is driven by the force of water returning to the tank, and is thus kept constantly in motion. The screen is of large area and semi-circular in shape, it is fitted with brushes mounted upon arms, which sweep the screen about 50 times per minute. By this method the water is allowed to pass through the screen to the front compartment of the tank, the pump being constantly supplied with clean water.

The machine has no intricate parts, and is constructed throughout of tested material. The water tank and dust tank are made from tool steel, heavily galvanised and enamelled, and are practically indestructible. They are tested up to four times the strength actually required. Although the "Invincible" cleaner has only been on the market for a short time, we understand that a considerable number are in use and giving complete satisfaction. The London General Omnibus Company have, at present, three installed.

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SHEFFIELD CORPORATION OMNIBUS SERVICE.

The accompanying illustration shows the assembled fleet of motor omnibuses now owned by Sheffield Corporation. Three of them are of the double-deck type and the other three are single-deckers, but all are of the Daimler make with 40-H P. silent Knight engines. Chain-driven gears are used, and the vehicles, which have Continental tyres, are lighted at night by Vandervell's electric lighting arrangement. The seating capacity of the double-deck omnibus is 36, and that of the single-decker 27, in each case including two passengers alongside the driver.

The omnibuses have been in service since the beginning of February, and up to the beginning of May they ran approximately 19,606 miles. Up to the present time the vehicles have given a very satisfactory service, and are so much appreciated that orders are being placed with the Daimler Company for additional omnibuses for other routes. The gradients on which the omnibuses are working are fairly steep, in one case being as much as 1 in 12 for a length of about 100 yards. These gradients are negotiated without trouble.

Motor Omnibuses of the Sheffield Corporation.

On Sundays an eight-minute service is maintained on one route, which branches out into the country for a distance of three miles from the tramway route, and on fine days the traffic is so heavy that a five-minute service would not be too much for the number of passengers who desire to avail themselves of the opportunity of getting out into the country districts.

The single-deck omnibuses are used on a route where there are two low railway bridges, which prohibit the use of either double-deck tramcars or double-deck omnibuses.

The Education Department have taken advantage of the provision of the omnibuses by making arrangements with the Tramways Committee for the conveyance of children each morning to an open-air school, which is situated some five miles from the centre of the city. The journey had previously to be made partly by tramcar and partly by horse wagonette.

It is too early yet to give any reliable figures regarding working expenses, but it will be interesting to see these worked out on the standard adopted by municipalities, and in a somewhat similar way to the standard form of tramway accounts.

THOMAS TILLING, LIMITED.

For the year ended December 31, 1912, the accounts of this company show a profit on trading of £21,994, which, added to £15,927 brought forward from last account, amounts to £37,921. After providing for interest on special loans (all of which are repaid) and on debentures, and deducting the interest on preference shares paid July 1, 1912, there remains a balance of £24,370. Of this £8,250 was paid to the preference shareholders on January 1 last, and the directors propose that the balance of £16,120 shall be carried to next account. During the year the stud, as far as the omnibus horse is concerned, has been considerably reduced to make room for motor vehicles, the forced sale of the former entailing considerable additional charges against the profits of the year. A large number of new motor vehicles has been added to stock, all of which are profitably employed. During the year the company has acquired a preponderating interest in the business of W. A. Stevens, Limited, motor manufacturers and engineers, who are the patentees of the electrical portion of the Tilling-Stevens motor omnibus.

Mr. R. S. Tilling, presiding at the meeting, said that in 1912 there was practically no summer at all, and the price of forage rose to an abnormally high figure. The effect of the high price during some weeks was responsible for an increased cost of over £800 a week over what would have been the case with normal prices. The company were now running 100 petrol-electric 'buses, and by the end of the year they would have 150 at work. These vehicles were running not only in London, but to such places as Bromley, Farnborough, Sidcup, Croydon, and Woolwich. They had also established a large business in private cars, trade vehicles, and in carrying the mails. At a subsequent extraordinary meeting, resolutions were passed dividing the ordinary shares into £1 shares, and agreeing to an increase of the capital by the creation of 200,000 ordinary shares of £1 each. The accounts showed a profit on trading for the year, after setting aside £831 for leases, sinking fund, and making provision for depreciation of plant, horses, and motor vehicles, of £21,994, and including £15,927 brought forward from the last account, there is a balance of £37,921. After providing for interest on special loans (all of which are repaid) and on debentures, and deducting the interest on preference shares

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MOTOR TRAFFIC.

paid on July 1, 1912, there remained £24,370. Of this, £8,250 was paid to the preference shareholders on January 1, and the directors recommended that the balance of £16,120 be carried to the next account. The report mentioned that during the year the number of horse omnibuses had been reduced to make room for motor vehicles, and a large number of new motor vehicles had been added to the stock, all of which were now being profitably employed.

PARADE OF INDUSTRIAL MOTORS.

The seventh annual parade of industrial motor vehicles took place on Whit-Monday, May 12, on the Thames Embankment and the adjacent streets in the neighbourhood of the Tate Gallery, and was a most successful demonstration of the increasing popularity of motor vehicles for all kinds of service. It was under the auspices of the Commercial Motor Users' Association, and the entries totalled 372, an increase of 97. Mr. T. B. Browne, president of the Institution of Automobile Engineers, was chairman of the judges. The appointment of Mr. George W. Watson as inspecting engineer, which was tried as an experiment last year, proved such a success that the same arrangement was followed this year with equal satisfaction. By this arrangement the judges were able to complete the whole of their work prior to the parade with the exception of the marks for appearance. The inspections by Mr. Watson commenced on January 1 last. Two written technical examinations, for petrol and steam respectively, were held at the Royal Automobile Club to determine the champion driver in each section, at which 48 petrol drivers and 15 steam drivers presented themselves. Prizes of £10 and £5 were awarded in each examination. New features of the parade were the parcel car and new vehicle sections. The team section, which has become a most popular feature, was again included, 22 teams competing for the silver challenge cup offered to the owner of the best team of six vehicles. A silver cup and a silver goblet were also competed for amongst engineers for the best vehicle or group of vehicles showing the best condition on parade.

The winners of the championship prizes were: £10 (petrol section), C. Hughesden, driver of a Commer Car van. In 1912 parade Hughesden won the first steam prize as driver of a Foden wagon. £10 (steam section), H. White, driver of Aveling and Porter tractor. Engineers' prizes: Silver cup, J. Maidens, of Schweppes, Limited; silver goblet, H. Cooper, of Thos. Tilling, Limited. In the 1912 parade Mr. Cooper took the first prize. Owners' prizes: Challenge cup for the best team of six vehicles, Messrs. Cannon and Gaze, for a team of two Hallford vans and four Foden steam wagons. The competition in this section was exceptionally keen, and a team of Albions, entered by Messrs. Spiers and Pond, was awarded a special prize of £3. The "Continental" cup was awarded to Selfridge and Company for a Halley van, which up to the end of September had run 50,700 miles. The new vehicle prizes (silver cups) were presented to Mr. H. Thomas, the owner of a Foden wagon; Mawers, Limited, for an Albion van; Selfridge and Company, Napier van; Waring and Gillow, Leyland van; X.Y.Z. Transport Company, Berna lorry; and the Daimler Company, for the Daimler saloon omnibus.

Five vehicles had over 100,000 miles to their credit prior to the end of September; 21 had covered upwards of 80,000, and 65 had completed over 50,000 miles. Commercial cars were again the most numerous vehicles, heading the list with 38. Foden vehicles came next with 36, Albion 27, Dennis 24, Thornycroft 22, Leyland 21, and Milnes-Daimler 19.

Speaking at the luncheon, Mr. Shrapnell Smith paid a high compliment to the organising ability of Captain Bagnall Wild, and said that much of the success of the parade was due to the excellent work he did during the time he was chairman of the Parade Committee and chief marshal. Mr. Arthur W. Windsor, the chief marshal for this year, and Mr. F. G. Bristow, secretary, also received well merited praise. Amongst the principal guests present at the official luncheon were Colonel R. E. B. Crompton, C.B. (chairman), Brigadier-General S. S. Long, Major-General F. B. Landon, Superintendent C. Wells, Lieut.-Colonel Fox (Salvage Corps), Major W. E. Donohue, A.S.C. (nominated by the War Office to assist with the judging), Captain G. C. Coleman, A.S.C., and Mr. W. J. Iden (London General OnimbusCompany).

Special firm prizes, limited to competition amongst drivers of vehicles which were either manufactured by the firm giving prizes or upon which material supplied by the particular firm was exclusively used, were given as follow: Albion Motor Company, Aveling and Porter, Avon India Rubber Company, Bradbury Son and Company, Carless, Capel, and Leonard, Commercial Cars, Commercial Tyre Company, J. W. and T. Connolly, Daimler Company, De Dion Bouton, Dennis Brothers, Dunlop Rubber Company, Englebert and Company, Fodens, R. Garrett and Sons, J. and E. Hall, Hans Renold, Leyland Motors, J. Liversidge and Son, Midland Rubber Company, Milnes-Daimler Mercedes, D. Napier and Son, Peter Union Tyre Company, Polack Tyre and Rubber Company, Anglo-American Oil Company, British Petroleum Company, Shrewsbury and Challiner, Silvertown Lubricants, St. Helens Cable and Rubber Company, and John I. Thornycroft Limited. The "Continental" Cup was presented to the owner of the highest marked vehicle fitted with Continental solid tyres by the Continental Tyre and Rubber Company, Limited.

NEW SERVICES IN GLOUCESTER.

The Bristol Tramways and Carriage Company, Limited, inaugurated services of taxi-cabs and motor chars-a-bancs in Gloucester on May 10. The inauguration took the form of a procession of 24 cabs and private cars and a number of chars a-bancs in the presence of a very large and admiring crowd. After parading the streets for about an hour the cars returned to George Street, and were inspected with a great deal of interest by the public. To a luncheon given by the company at the Wellington Hotel, a number of citizens had been invited. Mr. H. F. Cooper (general secretary of the company) was in the chair, and those present included Messrs. C. Challenger (Bristol manager), W. H. Munton (electrical engineer), and G. T. C. Edwards (engineer), Aldermen H. R. J. Braine and C. W. Poole, Mr. Trevor Powell, and Mr. J. Jennings. In reply to the toast, "Success to the Bristol Tramways and Carriage Company's New Undertaking," Mr. Cooper said that he was sorry that the Council had not seen their way clear to grant them licences for the public stands, for it would have been a great convenience to the public. Still, the company had come to Gloucester to stay, and he felt confident of the support of the citizens. Mr. Challenger reminded his hearers that the Bristol Company were in Gloucester for some 25 years prior to the Corporation taking over the tramways, and that, as he was the tramway manager in the old days, he could not be regarded as a stranger amongst them. He contended that the coming of the motor vehicles would greatly benefit both the county and city. Mr. Challenger also referred to the fact that the motor mail services now run by his company covered 150 miles in different directions, which converged at Gloucester. Royal mail motor cars were running every night from Cardiff, Birmingham, and Bath to Gloucester, and the postal authorities were so satisfied that there was a prospect of a considerable extension in the Midlands.

OMNIBUS AND TROLLEY RESTRICTIONS.

The House of Commons Committee presided over by Sir Ivor Herbert on May 1 passed the amended clauses in the Chesterfield Corporation Bill, under which the authority are made liable for one-third of the cost of any widening or providing any footpath outside their area, and for the extra expense entailed by an outside authority in maintaining and repairing the roads used by the motor omnibuses and trolley vehicles. The clauses are the first of the kind passed by the Committee, and will be treated as models for subsequent railless trolley bills. Failing agreement as to the extra expense, arbitration must be resorted to. The first arbitration is to take place at the end of one year, and subsequently at the expiration of every three years, or any less period as may be agreed upon. The Corporation are to keep daily records showing the rates, journeys, and mileage run by motor omnibuses and trolley vehicles, and the County Council are also to keep records. Such books and records are to be produced for inspection in relation to the determination of extra expense. The Corporation may at any time apply for the recession or modification of the provisions if, in view of future legislation, they shall think fit to do so.

L.G.O.C. TRAFFIC MANAGEMENT

Captain Dumble, who for some six years prior to the amalgamation of the London General Omnibus Company with the Underground Electric Railways held the position of joint general manager with Mr. Duff of the former undertaking, has retired from the company's service and the position has been abolished.

Captain Wilfrid C. Dumble went to the company straight from the Army, and displayed great organising power, as the undertaking gradually absorbed most of their competitors until the company had a virtual monopoly of the London omnibus traffic.

The management of the traffic department, with the exception of the arrangement of fares and routes, is now entirely in the hands of Mr. Walter J. Iden, the company's chief engineer. Mr. George Schave, works manager at Walthamstow, has been appointed chief assistant to Mr. Iden; Mr. John O'Neill being now in charge at Walthamstow. Mr. H. Lansdown, chief clerk to Mr. Iden, has been appointed traffic superintendent.

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MOTOR TRAFFIC.

MOTOR APPLIANCES FOR LONDON FIRE BRIGADE.

At a meeting of London County Council on May 6 the Fire Brigade Committee reported on tenders received for the supply of six petrol-driven motor fire engines, five petrol-driven motor escape vans, and one petrol-driven motor lorry for the fire brigade. For the fire engines the following were the tenders:

	Amount of Tender for Engines fitted with	
	Ordinary Tyres and Two Tyre Protectors.	Special Tyres without Tyre Protectors.
	£	£
Leyland Motors, Limited	5,040	5,190
Leyland Motors, Limited (alternative prices for engines of 40 H.P. instead of 50 H.P. as specified)	4,710	4,860
Henry Simonis & Co., Walthamstow ...	5,055	4,650 plus cost of tyres.
Dennis Brothers	5,370	5,658
Dennis Brothers (alternative prices for iron pumps instead of gun-metal pumps)	5,250	5,538
Merryweather & Sons...	6,480	6,603
Shand, Mason, & Co.	980 for only one engine.	—

The committee were advised that the engines offered by Dennis Brothers would be the most satisfactory for the fire brigade. They would be fitted with pumps capable of delivering 500 gallons a minute at a pressure of 120 lb. a sq. in., whereas the pumps fitted to the engines offered by Leyland Motors, Limited, and by Messrs. Simonis and Company would deliver 400 gallons a minute and 340 gallons a minute respectively, at the same pressure. The prices quoted by Dennis Brothers compared favourably with the amount of the chief officer's estimate and with the prices previously paid for petrol-driven motor engines, and the committee recommended that Dennis Brothers' tender should be accepted. They did not think it desirable to accept the alternative offer of Dennis Brothers for the provision of iron instead of gun-metal pumps. As regarded tyres, the committee were not prepared to recommend the acceptance of the quotation which provided for the fitting of special tyres, but they proposed that £120 should be added to the price quoted by the firm for ordinary tyres, so as to make sufficient provision for the fitting of special tyres to three of the six engines in the event of it being found possible to arrange for this at a satisfactory price. The amount of the tender recommended was thus £5,490.

The undermentioned tenders were received for the supply of five motor escape vans:

	£
Dennis Brothers	3,250
Henry Simonis and Company	3,300
Leyland Motors, Limited	3,375
Merryweather and Sons	4,550

The amount of the lowest tender was within the chief officer's estimate, and the committee proposed that it should be accepted.

For the supply of a petrol-drawn motor lorry the following tenders were received:

	£
Belsize Motors, Limited	537
Dennis Brothers	615
Commercial Cars, Limited	632
Clayton and Company, Huddersfield	638
John I. Thornycroft and Company	650
J. and E. Hall, Limited	660
Leyland Motors, Limited	685
Albion Motor Car Company	710

In view of the proposed acceptance of the tenders of Dennis Brothers for the other appliances, the committee considered it would be most advantageous to accept the tender of this company for the supply of the lorry. The amount was within the chief officer's estimate.

The committee also proposed that one of the horse-drawn turn-table ladders in use in the fire brigade should be adapted for motor traction. Cedes Electric Traction, Limited, had offered to supply the petrol electric chassis, etc., necessary, for £850, and the committee proposed that this offer should be accepted. The company promised delivery in four months, and it was proposed to sub-let the supply of the motor engine to the Aster Engineering Company.

The recommendations were adopted.

British Motor Spirit Syndicate.—The British Motor Spirit Syndicate, Limited, have filed a "statement in lieu of prospectus." Mr. Godfrey C. Isaacs is managing director, and the other members of the Board are Messrs. A. Armitage, F. P. Armstrong, E. Manville, F. Lamplough, P. J. Bird, and P. Heybourn. The last named went to New York with Mr. Isaacs in connection with the Marconi deal.

KEIGHLEY RAILLESS TROLLEY CAR INSTALLATION.

Keighley Corporation on May 2 received the provisional sanction of the Board of Trade to commence a service of cars on the Ingrow-Lees railless trolley route. The sanction is for three months. This is the first installation of the Cedes-Stoll system in this country, and the Board of Trade inspection was made by Major Pringle and Mr. C. P. Trotter. The system has been installed between the Ingrow terminus of the tramways and the village of Cross Roads, and it traverses nearly two miles of roadway in the districts of the Haworth Urban Council and the County Council. The smooth and almost noiseless running of the car was the most remarkable feature of the trial run. At Cross Roads the inspecting officers closely examined the car and its working parts. The car wheels contain the armatures of the motors, and there is no revolving axle, the hub of the wheel turning round the field magnets, which are bolted on a rigid bar. The overhead trolley has a flexible connection with the car. The contractors were the Cedes Electric Traction, Limited, at 112, Great Portland Street, London, W., and Stamford Hill Works, N., and Messrs. Clough, Smith, and Company, Limited, Spencer House, South Place, London, E.C. Amongst those who took part in the run as passengers were the Mayor of Keighley (Councillor W. A. Brigg), Councillor A. Smith (chairman of the Tramways Committee), Mr. J. Ackroyd (chairman of Haworth Urban Council), Mr. H. Webber (Keighley electrical engineer and tramways manager), and Mr. Hepworth (of the Highways Department of the County Council).

The Brighton Corporation's Powers.

A House of Lords Committee on May 5 passed the Brighton Corporation Bill which seeks powers to purchase the powers of the Brighton, Hove, and Preston Omnibus Company to install a railless trolley system from the eastern boundary of Brighton to Rottingdean, to extend the time for the completion of the work until August 7, 1917, to extend the route to Kemp Town station, and to construct an alternative route at the rear of Sussex Square. Power is also taken to run motor omnibuses during the construction of the railless system.

Railless Traction, Road Maintenance, and Widenings.

The House of Commons Committee which heard this bill, on May 6, accepted the following agreed clauses, and the bill was ordered to be reported for third reading: Contribution towards cost of widening and adaptation of roads: Within one month after the Council shall have widened the roads in which the trolley vehicle route will be situate (so as to provide a carriage way of the width of 17 ft. with a footpath of the width of 4 ft.) and shall have adapted such roads for the running of trolley vehicles thereon, the company shall pay to the Council one-third of the cost of such works, but not exceeding in the whole the sum of £1,333. Contribution towards road maintenance: The company shall pay to the Council one-third of the extra cost incurred by the Council in each year in maintaining the roads upon which the trolley vehicle route will be situate by reason of the running by the company of trolley vehicles upon such roads, but so that such one-third shall not exceed three-eighths of a penny per car-mile run by such trolley vehicles upon such roads during such year.

LONDON OMNIBUSES FOR MONTREAL.

Besides having undertaken to supply the motor omnibuses, the London General Omnibus Company are not unconnected with the Canadian Autobus Company, who, on the strength of a Federal Charter authorising them to run a service in any city in Canada, have decided to begin operations in Montreal within a few weeks. Two hundred vehicles will be utilised during the present year, and in the course of next year an increase to 350 will be made. The company will have London offices at 40 and 42, Broad Street, E.C., and Mr. Duncan Macdonald and Mr. V. H. Dandurand, the president and vice-president respectively of the company, will shortly be in England in connection with the despatch of the vehicles. Mr. Macdonald was formerly managing director of the Montreal Tramways Company, and has also served as manager of the Paris tramways. While with the Montreal Tramways Company he and a fellow Scotchman, Mr. Ross, invented the pay-as-you-enter system, which is now universal in America and is winning its way in Great Britain. Some influential Canadians are on the board of the company, which has an authorised capital of £2,000,000. Among the number are Messrs. S. Holt and J. S. Norris, of the Montreal Light, Heat, and Power Company; Mr. McGibbon, of the Consolidated Rubber Company; and Mr. F. L. Wanklyn, general executive assistant of the Canadian Pacific Railway. On this side of the Atlantic the directorate comprises Lord Maitland, Mr. D. McMaster, K.C., M.P., and Mr. D. Duff, formerly secretary and now a director of the London General Omnibus Company.

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MOTOR TRAFFIC.

MOTOR TRAFFIC NOTES.

ROAD BOARD PROVIDING LOANS FOR MOTOR VEHICLES.—An offer of a loan for the purchase of a motor tractor and two trailers for road construction work has been made to the Linlithgow District Committee by the Road Board.

TRAMWAY COMPANIES AND SELF-PROPELLED VEHICLES.—The Isle of Thanet Tramway and Lighting Company have increased the number of petrol motor vehicles which they are running to various points in the district, including Deal.

THE CARE AND USE OF SOLID TYRES.—Users of solid rubber tyres for motor vehicles will find useful information embodied in a booklet with the above title published by the Dunlop Rubber Company, Manor Mills, Birmingham. Copies may be obtained on application to the company.

OMNIBUS COMPETITION WITH A RAILWAY. Mention was made at the recent annual meeting of the Charnwood Forest Railway Company that during the ensuing year the passenger traffic might not be so successful, owing to the competition of the motor omnibus between Loughborough and Shepshed.

OMNIBUSES FOR OLDHAM TRAMWAYS DEPARTMENT.—On May 12 a motor omnibus service was inaugurated with a single petrol-electric vehicle between the Town Hall and the Coppice. A second omnibus was delivered a few days afterwards by the builders, W. A. Stevens, Limited, 26, Victoria Street, London, S.W.

PROSPECTIVE MOTOR OMNIBUS SERVICE IN IRELAND.—In connection with a mineral tramway to be constructed by the Castlecombe Tramways Company, Kilkenny, the company state that if any general demand was made for a passenger service they would put motor omnibuses on the road such as were running from Kilkenny to Callan.

MANCHESTER CORPORATION'S ORDER FOR OMNIBUSES.—The Tramways Committee have approved of the following work being undertaken by sub-contractors in connection with the supply of four omnibuses by the Daimler Company, of Coventry: Bodies, Christopher Dodson, Limited, London; tyres, Shrewsbury and Challiner Tyre Company, Manchester.

NEW TYPE OF OMNIBUS AT EDINBURGH.—The Scottish Motor Traction Company are building a single-deck omnibus divided into two compartments—smoking and non-smoking—for their Edinburgh, Broxburn, and Uphall services. Each vehicle holds 36 passengers, and the seats are fitted with spring backs and spring cushions, upholstered in green leather.

PETROL-ELECTRIC COACHES FOR RAILWAYS.—The British Westinghouse Company two years ago, supplied a petrol-electric coach for service on a London suburban line of the Great Central Railway. Its satisfactory working has led to orders being received from the London and North Western Railway, Cuban Central Railways, and the New Zealand Government Railways. These orders are now in course of execution.

STOPPING PLACES OF OMNIBUSES AND TRAMCARS.—Camberwell Council have supported a suggestion made by the police that owing to the narrowness of Peckham Road outside the Town Hall, motor 'buses travelling in either direction should stop at least one length behind the cars. The London County Council Tramways Department had suggested that the 'buses should stop one length in front of the cars travelling in one direction.

CALEDONIAN RAILWAY COMPANY ADOPT ROAD MOTOR TRACTION.—Commercial Cars, Limited, have supplied a 27-H.P. chars-a-banc to the Caledonian Railway Company, who have not hitherto used self-propelled road vehicles. It seats 16 persons, and will be utilised to link up the Callander and Oban Railway at Lockawe and Dalmally with the steamboat service at Inveraray. As the route is very hilly, extra brakes will be fitted to the rims of the driving wheels.

PLIGHT OF THE CAMBRIDGE HORSE TRAMWAYS.—Cambridge Corporation have referred to a sub-committee a letter from the Street Tramways Company stating that the competition of the motor omnibuses has become so great that the directors will have no option but to advise a cessation of the tramway service unless something can be done to modify the rivalry. During the past ten years the company have contributed £3,700 towards the upkeep of the roads, rates, etc.

BIRMINGHAM AND MOTOR OMNIBUSES.—The City Council on May 20 authorised the Tramways Committee to purchase 10 suitable motor omnibuses at a cost not exceeding £10,000, to include spare parts and other equipment. The committee have since placed an order with the Daimler Motor Company, of Coventry, for 10 double-deck omnibuses identical in design with those recently supplied by the Daimler Company to Sheffield Corporation. The order constitutes the largest one yet placed by a local authority with any manufacturer.

HORSE TEAM LABOUR TESTED AGAINST A MOTOR.—The Cleansing Committee of Bury Town Council have reported upon the result of a five days' test with nine horses as against a motor vehicle. The horses conveyed 185 tons 13 cwts. at a cost of £22 10s., and the motor 163 tons 2½ cwts., the cost per ton being equal to 2s. 5d. for the horses, and 1s. 10d. for the motor. For night work only, six horses had conveyed 127 tons 15 cwts., and the motor 123 tons 15 cwts., the comparative cost per ton being: horses, 2s. 4½d, motor, 1s. 2½d. The Council intend to purchase another motor wagon.

FLEET STREET TRAFFIC CENSUS.—In his seventh annual census of traffic in Fleet Street, contributed to *Motor Traction*, by Mr. H. H. Griffin, the enumeration extended over 12 hours. Of motor vehicles there were 5,244, horse 4,296, and 2,023 cycles. Motor 'buses numbered 3,518, and there were no horse 'buses. Motor cabs showed a total of 1,442, horse cabs 132, motor cars 140, horse carriages 212. Motor omnibuses showed an increase of 748, and motor cabs a decrease of 541, the falling off in the latter being attributed to the unsettling influence of the recent strike. Motor vans numbered 135, as against 104 in 1912 and only 62 in 1911. Mr. Griffin observes that if a party of horse-van owners could only pass 12 hours with him in viewing the ceaseless parade slowed down by horse vehicles they would soon be converted.

THE LATEST LONDON OMNIBUS.—A small number of gearless omnibuses are now in evidence on the east to west traffic route. They are being run by the Gearless Motor Omnibus Company, Limited, of which Mr. E. Manville is the chairman. Arrangements have been made with the London General Omnibus Company whereby the new undertaking are entitled for a period of 30 years to possess and run 20 omnibuses in the metropolis. The new vehicles, which are of a slate colour, are being run as a portion of the fleet of the London General Omnibus Company, and 10 of them are constructed by the Daimler Company. In order to provide an additional 10 omnibuses as soon as possible, the London and Suburban Traction Company have subscribed for 10,000 ordinary shares of £1 each at par.

CONTINENTAL TYRES.—It may interest readers to know that the average of 18,346 miles per tyre, particulars of which were given in an advertisement of the "Continental" tyres which appears in our issue of May 8, was made on Tilling's petrol-electric 'buses. A letter received from Messrs. Tillings since the publication of the figures referred to shows the following results:

		Total.	Average.
264 tyres	1010 × 120 "T" pattern	5,207,664 miles	19,726 miles
323 "	1000 × 100 "T" "	6,209,675 "	19,225·9 "
90 "	900 × 120 "T" "	2,222,730 "	24,697 "
		13,640,069 "	20,147·8 "

SOUTH METROPOLITAN TRAMWAYS ADOPT MOTOR OMNIBUSES.—In connection with the alliance of the South Metropolitan Tramways with the London and Suburban Traction Company it is of interest to note that the former company have decided to run 10 motor omnibuses. At a meeting of the Traction Company, at which the fusion was agreed to, the chairman, Mr. C. B. Stuart-Wortley, stated that the effect would be that the South Metropolitan Tramways would pass under the control of a company interested in converting the competing motor omnibuses into friends and feeders of its system, and in ensuring that their own 10 new 'buses should be run at the maximum profit that co-operation could secure, as well as in establishing new points of contact and attractive through traffic with the great existing tramway systems now operating near to the district and extending therefrom over a large district on both sides of the Thames.

MR. A. H. STANLEY AGAINST FIXED STOPPING PLACES FOR OMNIBUSES.—In the course of his evidence given at the last sitting of the Select Committee of the House of Commons on accidents caused by power-driven vehicles in London, Mr. A. H. Stanley, managing director of the London Underground Railways and the London General Omnibus Company, in reply to a question, stated that he did not think that the 'buses caused any danger through being able to pull up anywhere in order to set down or pick up passengers, and not having fixed stopping places. Fixed stopping places for 'buses would not have any bearing on the question of accidents, in his opinion. It would cause congestion, and would reduce the efficient working of the 'bus, as one of its advantages over the tramcar was its ability to pull up at any time. If fixed stopping places were imposed there would be a long queue of people waiting to board them, as was seen in Paris. He quite agreed with fixed stops for tramcars, as those vehicles were of a different nature from motor 'buses.

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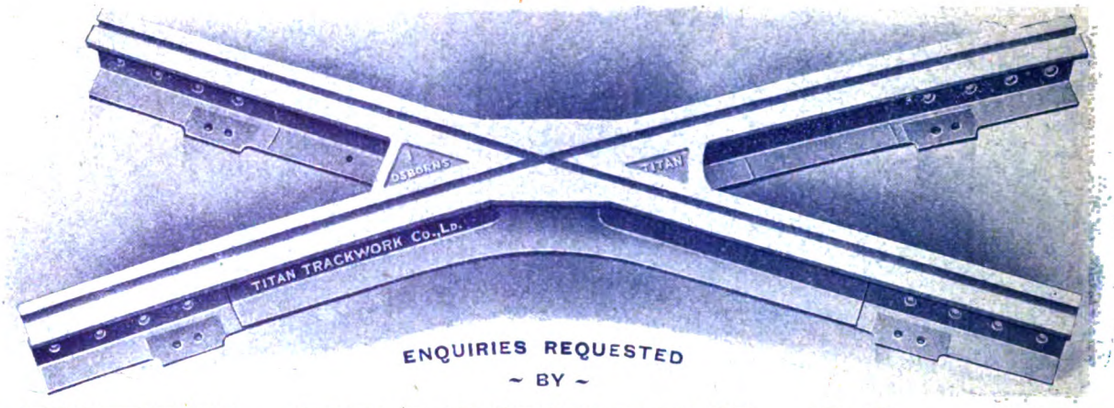

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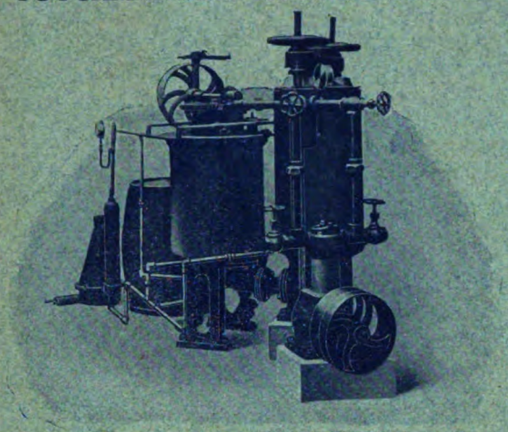

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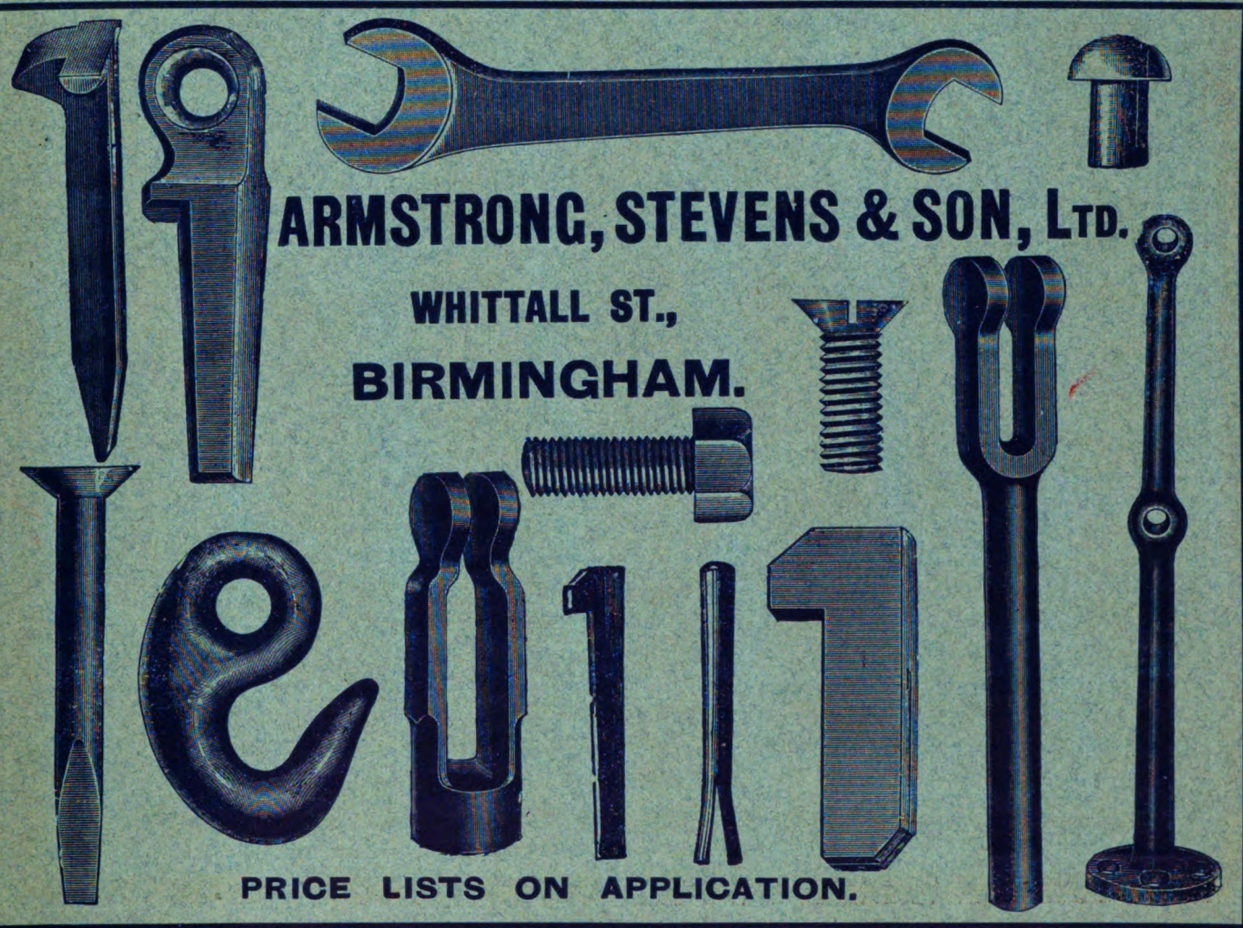

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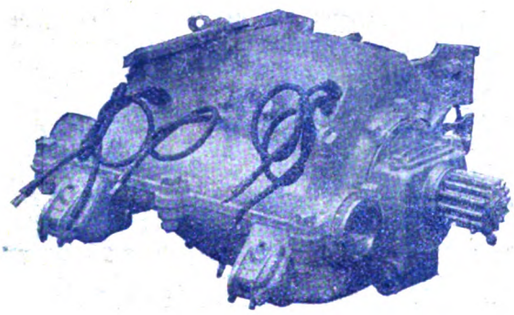

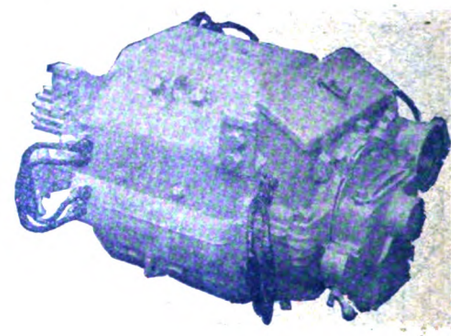

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(REGISTERED AS A NEWSPAPER.)

PRICE ONE SHILLING.

FEBRUARY 6, 1913.
Vol. XXXIII., No. 7.
WITH
"MOTOR TRAFFIC" SECTION

Contents, Page xi.
Index to Advertisements, Page xiii.

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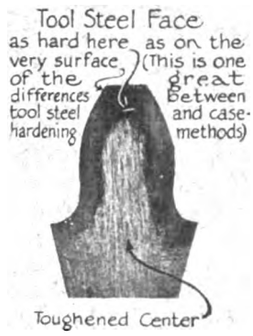

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WITH
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MAY 9 1913

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WITH
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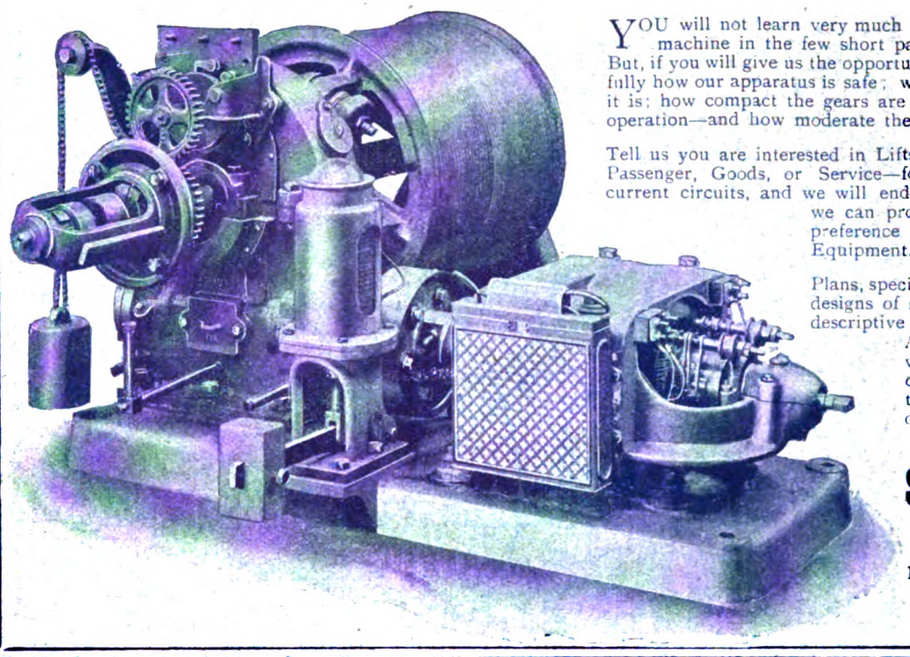

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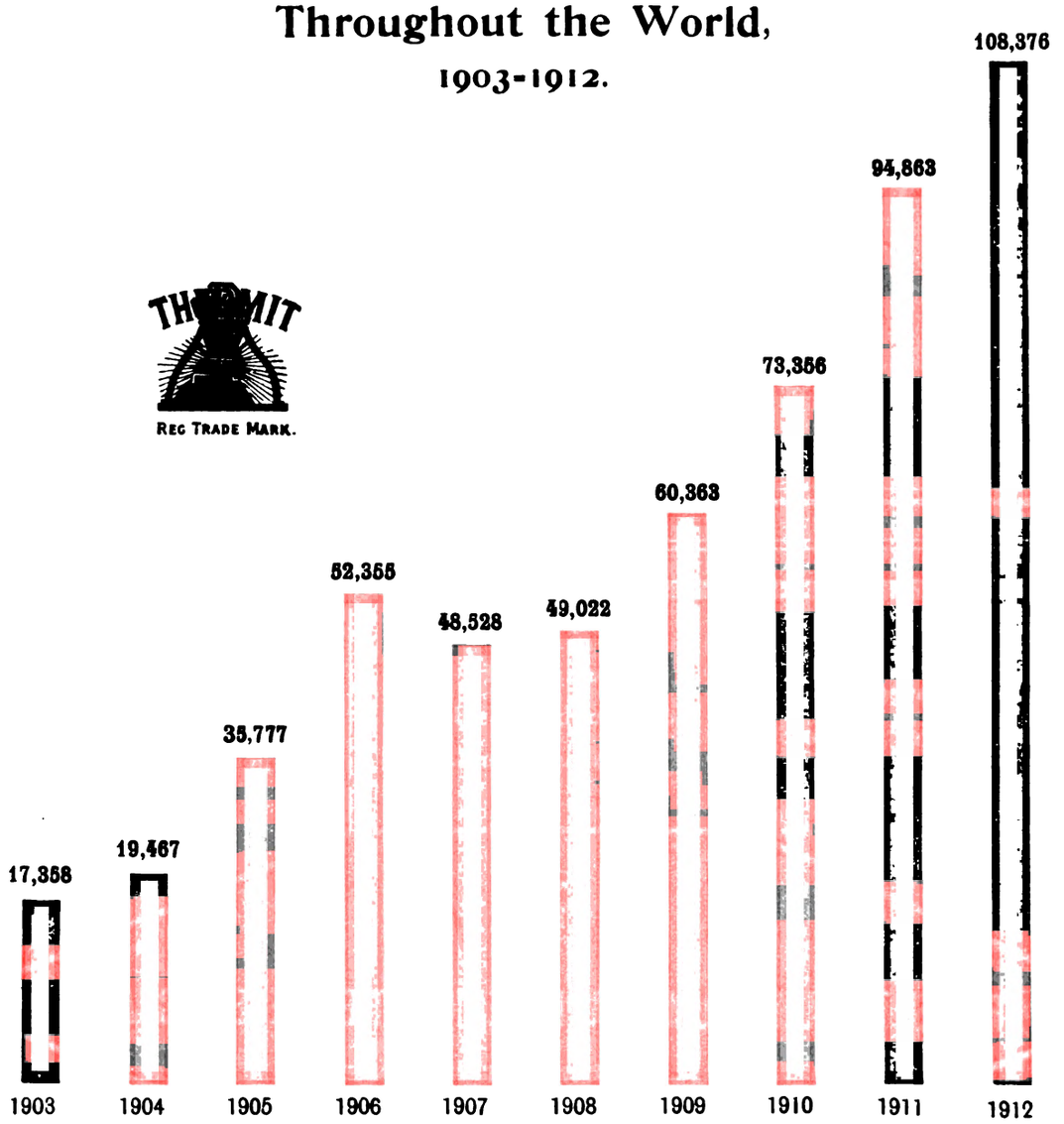

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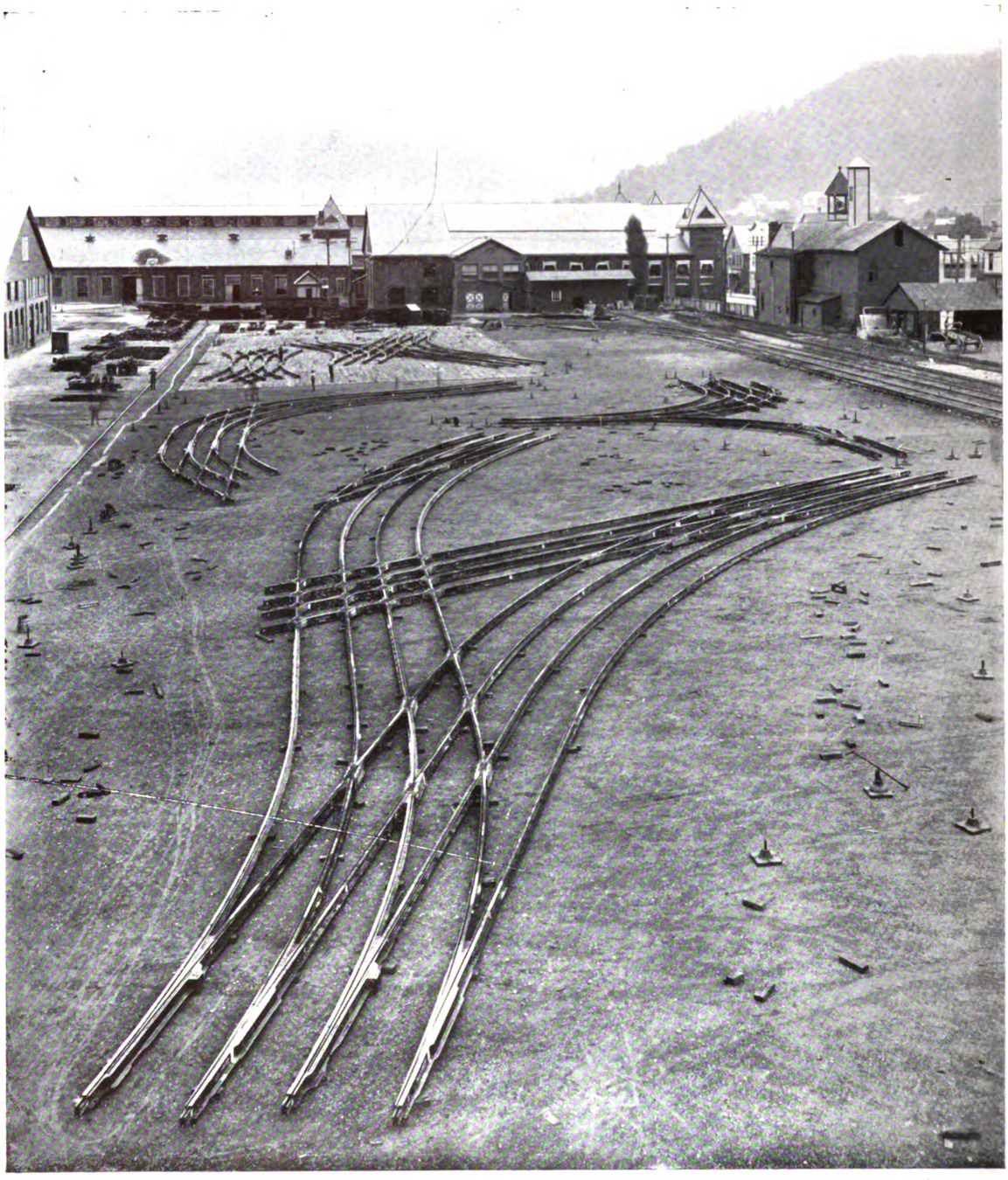

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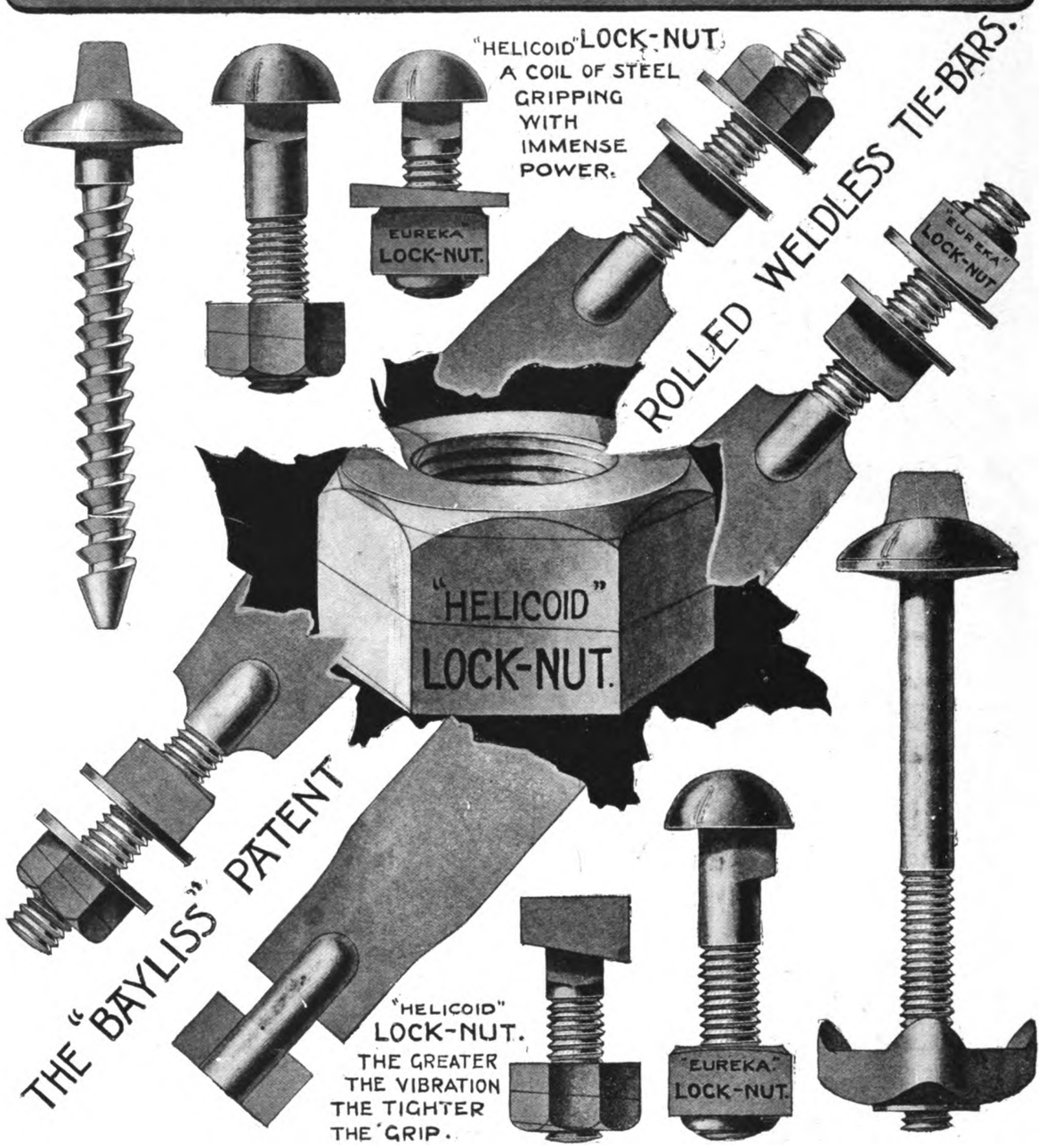

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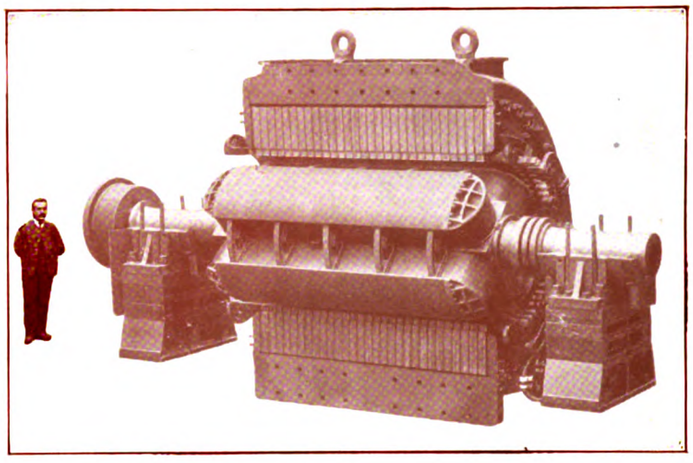

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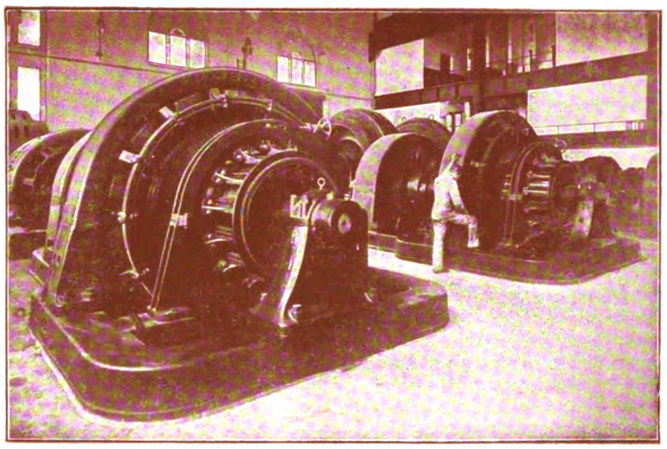

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for carriage of passengers, goods, minerals, and produce.

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"The roads over which the trolley vehicles ran were in excellent condition at the present time, and had not been damaged in the slightest degree by the running of the trolley vehicles. The prospects of the trolley vehicles were decidedly bright. The result, he thought, at the end of the financial year would be all they could possibly desire. They had exceeded at present his most sanguine expectations. The receipts of the Broom Road tramway section had gone up from 6½d. to 11d. per car mile, and the normal receipts of the trolley vehicle system to Maltby were above 10d. or 11d. per car mile. These receipts had been taken in the worst part of the year. Financially, and otherwise, the undertaking was a great success."

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'ERA' MANGANESE STEEL

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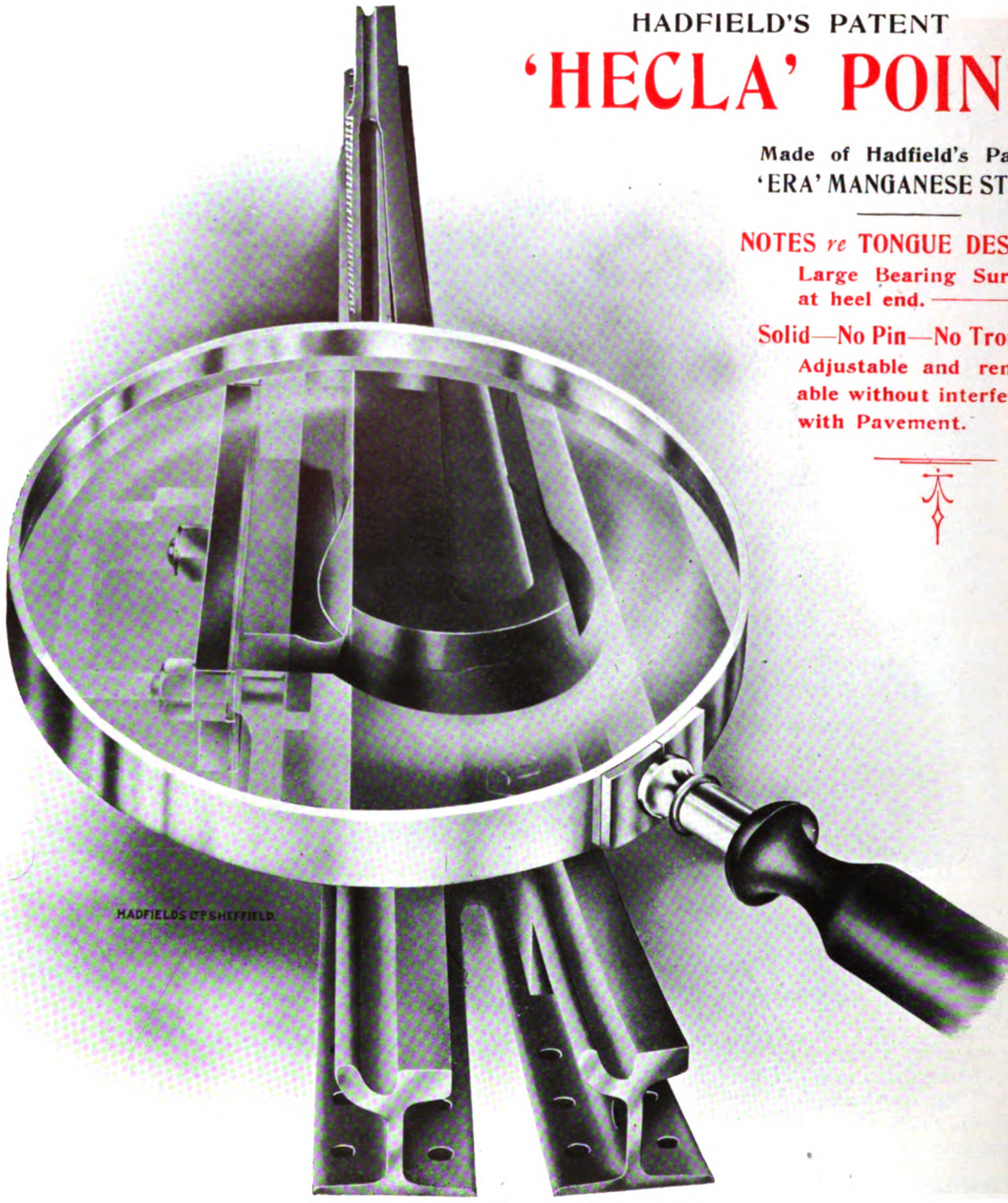
Large Bearing Surface at heel end.

Solid—No Pin—No Trouble

Adjustable and renewable without interfering with Pavement.



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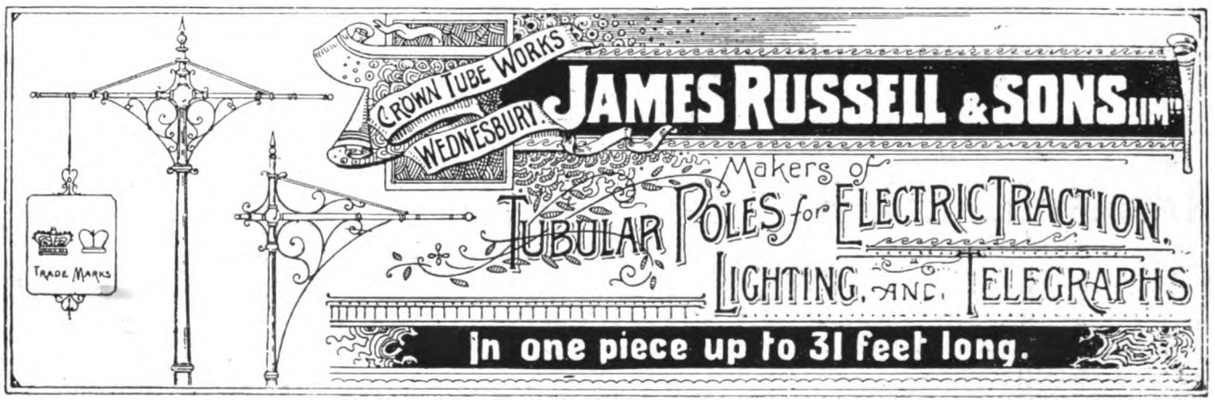

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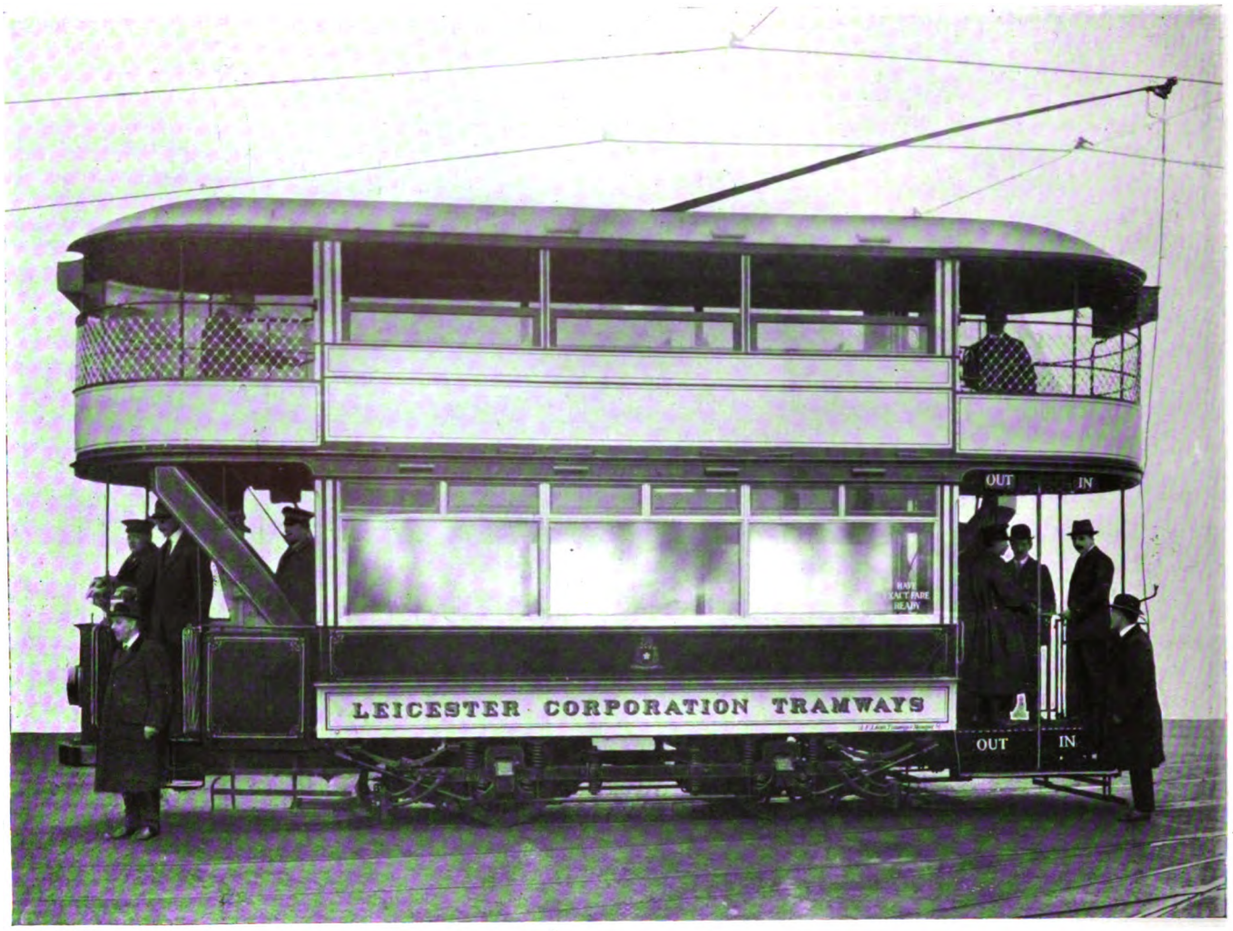

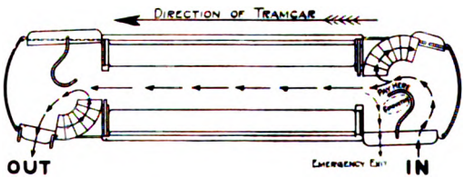

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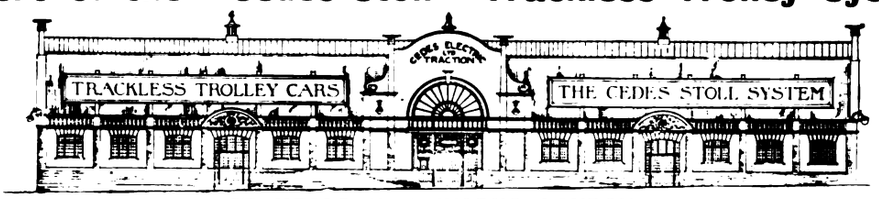

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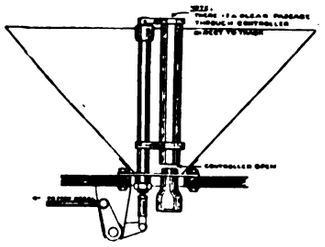

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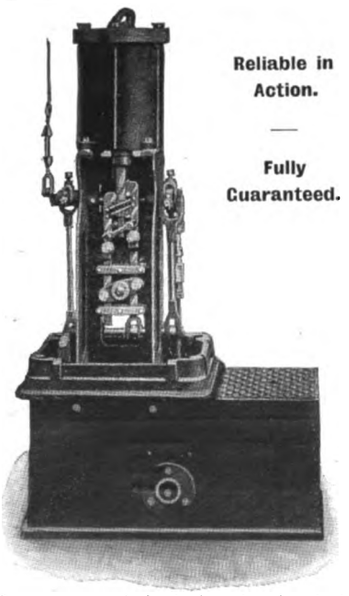

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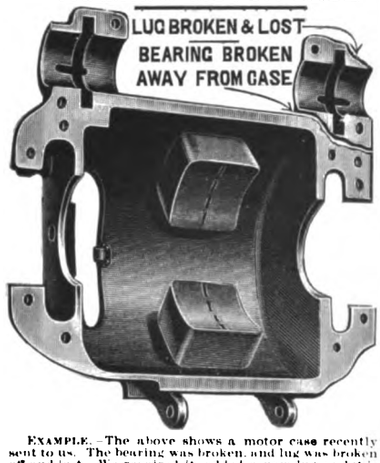

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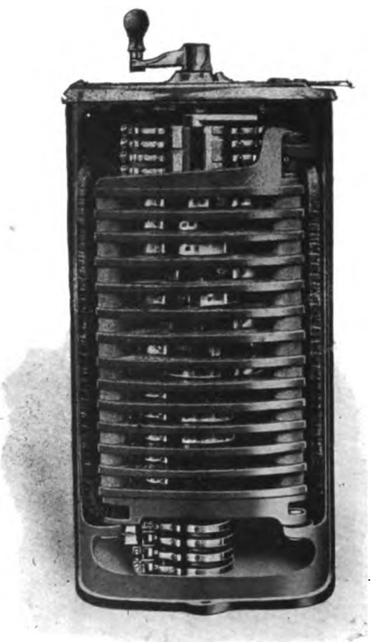

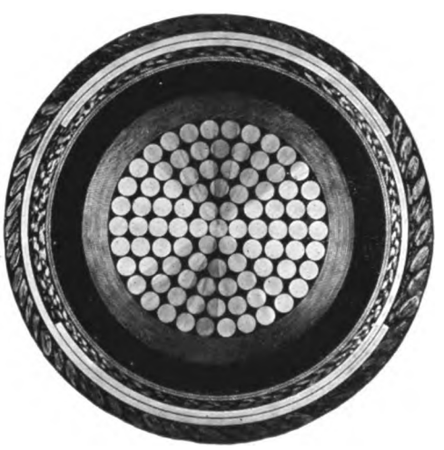

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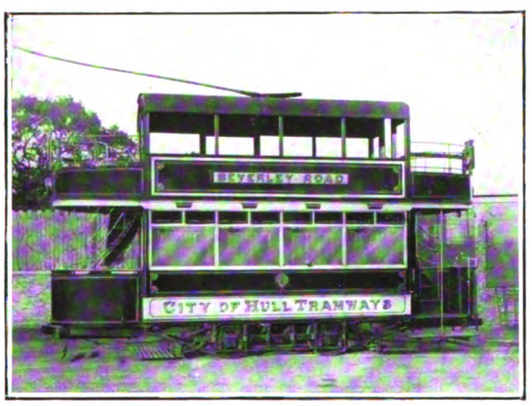

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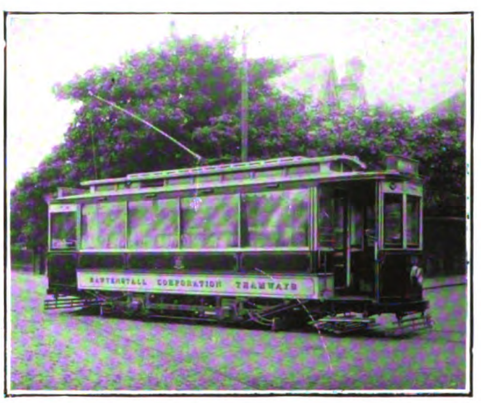

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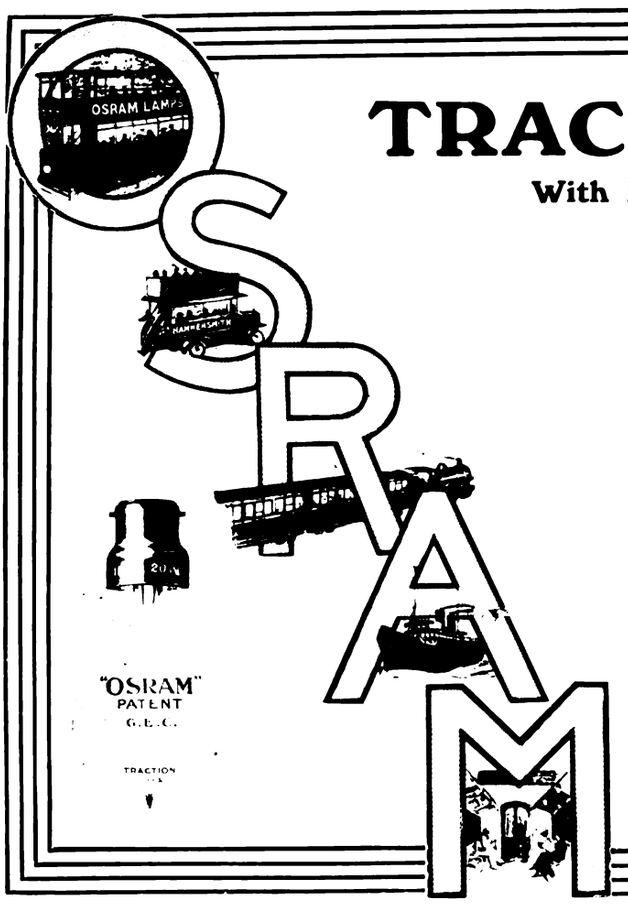

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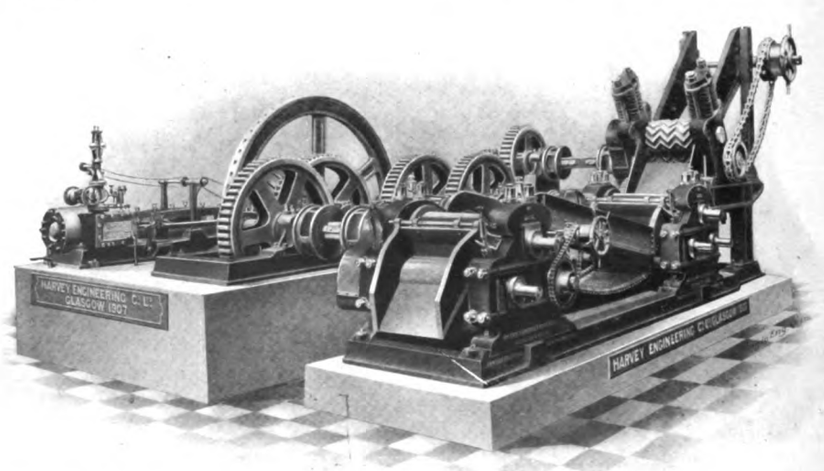

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MUNICIPAL TRAMWAYS, pp. xxv-xxvi. COMPANY TRAMWAYS, pp. xxvi-xxx. PARTICULARS OF TRACK AND EQUIPMENT, pp. xxxi-xxxiv.

Aberdeen Corporation Tramways, Municipal Buildings, Union Street, Aberdeen. [T.A., Trams, Aberdeen: T.N. 826.] *Gen. Manager and Eng.*, R. S. Pilcher; *Per. Way Eng.*, Wm. Dyack; *Chairman Try. Com.*, Coun. J. A. Smith.

Accrington Corporation Tramways, Market Hall, Accrington. [T.A., Trams, Accrington; T.N., 212.] *Gen. Manager and Eng.*, H. Pilling; *Per. Way Eng.*, W. J. Newton; *Chairman Try. Com.*, Ald. T. E. Higham; *Vice-Chairman*, Coun. C. F. Bury.

Ashton-under-Lyne Corporation Tramways, Tramway Depot, Mossley Road, Ashton. [T.A., Tramways, Ashton; T.N., 325.] *Gen. Manager*, Ernest Holt; *Elec. Eng.*, N. Appelbee; *Chairman Try. Com.*, Coun. R. S. Oldham; *Vice-Chairman*, Coun. Waterhouse.

Aston Manor Corporation Tramways, Council House, Aston Manor. *Consulting Eng.*, Robert Green; *Town Clerk*, J. Ansell; *Chairman Try. Com.*, Ald. W. Evans, J.P.

[Lines leased to City of Birmingham Tramways Co., *q.v.*]

Ayr Corporation Tramways, Town Building, Ayr. [T.A., Trams, Ayr; T.N., 123.] *Gen. Manager and Eng.*, William Grant; *Burgh Elec. Eng.*, R. Marshall; *Per. Way Eng.*, John Young; *Rolling Stock Supt.*, Alf. Somerville; *Convener Try. Com.*, Police-Judge P. S. Ferguson.

Bacup Corporation Tramways.—Town Hall, Bacup, Lancs. *Town Clerk*, J. Entwistle; *Boro' Eng.*, W. H. Elce; *Chairman Try. Com.*, Ald. J. H. Maden; *Vice-Chairman*, Ald. J. Craven Hoyle.

Barking Town Urban District Tramways, East Street, Barking. [T.N., 156 Barking.] *Manager and Elec. Eng.*, W. Holmes; *Chairman Try. Com.*, Coun. A. J. Blake.

Barton-upon-Irwell District Council Light Railways, Barton-upon-Irwell.

[Line leased to and worked by the Lancashire United Tramways Co., *q.v.*]

Batley Corporation Tramways, Batley, Yorks. *Engineer*, S. D. Jones; *Chairman Try. Com.*, Coun. J. W. Turner; *Vice-Chairman*, Coun. W. A. Parker.

[Lines leased to and worked by the Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Belfast City Tramways, Tramways Office, Sandy Row, Belfast. [T.A., Nance, Tramway, Belfast; T.N., 2444.] *Gen. Manager*, Andrew Nance; *Traffic Manager*, R. McMaster; *City Elec. Eng.*, T. W. Bloxam; *Per. Way Eng.*, E. S. Pinkerton; *Chief Eng.*, A. A. Blackburn; *Chairman Try. Com.*, Ald. Sir Robert Anderson, Bart., D.L., J.P.; *Vice-Chairman*, Ald. J. S. Finnigan.

Bexley Urban District Council Tramways, Car Sheds, Bexleyheath, Kent. [T.A., Stokes, Bexleyheath; T.N., 79.] *Gen. Manager and Elec. Eng.*, H. P. Stokes; *Rolling Stock Supt.*, A. Williams; *Chairman Try. Com.*, Coun. A. Rattenbury.

Birkenhead Corporation Tramways, Laird Street, Birkenhead. [T.A., Tramways Manager, Birkenhead; T.N., 1110.] *Borough Elec. Eng. and Gen. Manager*, W. Wyld; *Borough Sur. and Eng.*, C. Brownridge; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Coun. H. Halsall; *Vice-Chairman*, Coun. W. N. Dickie.

Birmingham Corporation Tramways, The Council House, Congreve Street, Birmingham. [T.N., 4609.] *Gen. Manager*, A. Baker; *City Elec. Eng.*, R. A. Chattock; *Traffic Supt.*, J. McDonnell; *Per. Way Eng.*, C. E. S. Bill; *Rolling Stock Supt.*, R. H. Dickinson; *Chairman Try. Com.*, Coun. H. Barrow, J.P.

Blackburn Corporation Tramways, 2, Salford, Blackburn. [T.A., Tramways, Blackburn; T.N., 547.] *General Manager*, J. H. Cowell; *Elec. Eng.*, P. P. Wheelwright; *Traffic Manager*, E. Greek; *Car Shed Supt.*, H. W. Seymour; *Chairman Try. Com.*, Ald. W. Thompson; *Vice-Chairman*, Coun. C. Higham.

Blackpool Corporation Tramways, West Caroline Street, Blackpool. [T.N., 67.] *Gen. Manager*, C. Furness; *Traffic Supt.*, C. J. Baker; *Resident Eng.*, F. Field; *Chairman Try. Com.*, Ald. J. Brodie, J.P.; *Vice-Chairman*, Coun. Holt.

Bolton Corporation Tramways, Bradshawgate, Bolton. [T.A., Manager, Tramways, Bolton; T.N., 490.] *General Manager and Elec. Eng.*, A. A. Day; *Traffic Manager*, J. Barnard; *Per. Way Eng.*, E. Ll. Morgan; *Rolling Stock Supt.*, F. Taylor; *Chairman Try. Com.*, Ald. J. Miles; *Vice-Chairman*, Ald. J. Harwood.

Bootle Corporation Tramways, Electricity Works, Pine Grove, Bootle. [T.N., 424.] *Elec. Eng.*, T. D. Clothier; *Chairman Try. Com.*, Coun. Booth; *Vice-Chairman*, Coun. Pennington.

[Lines worked by Liverpool Corporation Tramways.]

Bournemouth Corporation Tramways, Tramways Offices, Lansdowne Crescent, Bournemouth [T.A., Tramways, Bournemouth; T.N., 1701.] *General Manager*, I. Bulfin; *Chief Assistant & Elec. Eng.*, H. Vickers; *Traffic Supt.*, R. O. Baldwin; *Chairman Try. Com.*, Coun. A. Davis; *Vice-Chairman*, Coun. R. F. Godfrey.

Bradford Corporation Tramways, Central Office, 7, Hall Ings, Bradford. [T.A., Tramways, Bradford; T.N., 2381 and 2382.] *Gen. Manager*, C. J. Spencer; *Asst. Elec. Eng.*, J. W. Dawson; *Traffic Supt.*, T. Stirk; *City Elec. Eng.*, T. Roles; *Chairman Try. Com.*, Coun. Enoch Priestley; *Vice-Chairman*, Coun. S. C. T. Neumann.

Brighton Corporation Tramways, Lewes Road, Brighton. [T.A., Tramways, Brighton; T.N., 353 P.O.] *Eng. & Manager*, William Marsh; *Traffic Supt.*, W. N. Brooks; *Rolling Stock Supt.*, W. Orchard; *Per. Way Eng.*, F. N. Hudson; *Chairman Try. Com.*, Ald. F. T. Wilson.

Burnley Corporation Tramways, Queen's Gate, Burnley. [T.N., 46.] *Gen. Manager*, Henry Mozley; *Boro. Elec. Eng.*, J. E. Starkie; *Boro. Surveyor*, G. H. Pickles; *Chairman Try. Com.*, Coun. E. Heap; *Vice-Chairman*, Coun. A. M. Sinclair.

Burton-on-Trent Corporation Tramways, Guild Street, Burton-on-Trent. [T.N., 202.] *Manager*, A. B. Slater; *Engineer*, T. Hall; *Chairman Try. Com.*, Ald. J. S. Rowland; *Vice-Chairman*, Ald. T. E. Lowe.

Bury Corporation Tramways, Market Place, Bury. [T.N., 26.] *Gen. Manager*, William Clough; *Boro. Elec. Eng.*, S. J. Watson; *Chairman Try. Com.*, Ald. T. S. Collinge; *Vice-Chairman*, Coun. Hargreaves.

Cardiff Corporation Tramways, Central Offices, The Hayes, Cardiff. [T.A., Tramways, Cardiff; T.N., 1211, 1240, 1350, 1378, and 1379.] *Gen. Manager and Elec. Eng.*, A. Ellis; *Traffic Manager*, H. David; *Per. Way Eng.*, W. Harpur; *Rolling Stock Supt.*, Jas. Preston; *Chairman Try. Com.*, Ald. Sir J. W. Courtis, J.P.; *Vice-Chairman*, Coun. H. C. Vivian.

Chester Corporation Tramways, Station Road, Chester. [T.N., 166.] *Manager*, J. Gardner; *Elec. Eng.*, S. E. Britton; *Per. Way Eng.*, W. M. Jones; *Chairman Try. Com.*, Ald. J. Jones; *Vice-Chairman*, Ald. J. Dodd.

Chesterfield Corporation Tramways, Chatsworth Road, Chesterfield. [T.A., Tramways, Chesterfield; T.N., 78.] *Gen. Manager and Elec. Eng.*, R. L. Acland; *Traffic Manager*, F. Root; *Per. Way Eng.*, C. E. Crossley; *Chairman Try. Com.*, Ald. E. Shentall; *Vice-Chairman*, Coun. J. E. Clayton.

Colchester Corporation Tramways, Magdalen Street, Colchester. [T.A., Tramways, Colchester; T.N., 92.] *Gen. Manager and Engineer*, R. C. Bullough; *Chairman Try. Com.*, Coun. A. M. Jarmin; *Vice-Chairman*, Coun. J. T. Bailey.

Coventry Corporation Tramways, Priestley's Bridge, Coventry, and 8, Crosby Square, London, E.C. [T.A., Tramways, Coventry; T.N., 372.] *Engineer and General Manager*, T. R. Whitehead; *Electrical Engineer*, W. M. Milnes; *Chairman*, Coun. M. K. Pridmore; *Vice-Chairman*, Coun. S. Bettman.

Croydon Corporation Tramways, Tramways Office, Thornton Heath, Surrey. [T.N., 406, Croydon.] *Tramways Manager*, T. B. Goodyer; *Chairman Try. Com.*, Coun. F. Denning; *Vice-Chairman*, Coun. J. O. Pelton.

Darlington Corporation Tramways, Haughton Road, Darlington. [T.A., Tramways, Darlington; T.N., 135.] *General Manager and Elec. Eng.*, J. R. P. Lunn; *Traffic Manager*, G. A. Baxter; *Chairman Try. Com.*, Councillor T. E. B. Bates.

Dartford Urban District Council Tramways, Dartford. *Chairman Try. Com.*, Coun. S. K. Keyes; *Vice-Chairman*, Coun. T. Allen.

[Lines leased to and worked by Messrs. Balfour, Beatty, & Co. See Dartford Tramways in list of Tramway Companies.]

Darwen Corporation Tramways, Lorne Street, Darwen. [T.N., 104.] *Gen. Manager and Eng.*, F. J. S. Hosken; *Boro. Elec. Eng.*, C. H. Garnett; *Boro. Surveyor and Eng.*, R. W. Smith-Saville; *Chairman Try. Com.*, Ald. Jas. Tomlinson; *Vice-Chairman*, Coun. G. P. Holden.

Derby Corporation Tramways, 4, Victoria Street, Derby. [T.N., 410.] *Gen. Manager*, F. Harding; *Elec. Eng.*, T. P. Wilmshurst; *Per. Way Eng.*, J. Ward; *Chairman Try. Com.*, Ald. R. W. Spriggs; *Vice-Chairman*, Ald. T. Fletcher.

Doncaster Corporation Tramways, Grey Friar's Road, Doncaster. [T.A., Rayner, Doncaster, T.N., 43.] *Manager & Elec. Eng.*, E. S. Rayner; *Chairman Try. Com.*, Coun. P. Stirling; *Vice-Chairman*, Coun. Balmforth.

Dover Corporation Tramways, Town Hall, Dover. [T.A., Trams, Dover; T.N., 219 D.] *Gen. Manager*, E. Carden; *Per. Way Eng.*, W. C. Hawke (Boro. Surveyor); *Chairman Try. Com.*, Coun. Wm. Bromley (Mayor); *Vice-Chairman*, Ald. F. G. Wright, J.P.

Dundee Corporation Tramways, Town House Buildings, Dundee. [T.N., 1340] *Gen. Manager and Eng.*, Peter Fisher; *Elec. Eng.*, H. Richardson; *City Eng.*, J. Thomson; *Chairman Try. Com.*, Coun. Johnston.

East Ham (Borough of) Corporation Tramways, Nelson Street, East Ham. [T.N., 611 and 100, East Ham.] *Gen. Manager and Elec. Eng.*, W. C. Ullmann; *Chairman Try. Com.*, Coun. W. T. Howlett.

Eccles Corporation Tramways, Eccles. *Elec. Eng.*, H. W. Angus; *Per. Way Eng.*, T. S. Picton; *Chairman Try. Com.*, Ald. W. J. Nuttall, J.P.; *Vice-Chairman*, Coun. Ogden.

[Lines worked by Salford Corporation.]

Erith Urban District Council Tramways, Tramway Depôt, Walnut Tree Road, Erith. [T.A., Tramways, Erith; T.N., 36.] *Gen. Manager and Elec. Engineer*, A. Coveney; *Cons. Engs.*, Hawtayne and Zeden; *Chairman Try. Com.*, Coun. G. C. Humphreys.

Exeter Corporation Tramways, Paris Street Exeter. *Manager*, H. C. Bartlett; *Elec. Eng.* H. D. Munro; *Per. Way Eng.*, T. Moulding; *Chairman Try. Com.*, ; *Vice-Chairman*, Coun. T. Linscott.

Farnworth Urban District Council Tramways, Albert Road, Farnworth. *Chairman Try. Com.*, Coun. W. B. Richardson.

[Lines leased to the South Lancashire Tramways Co.]

Glasgow Corporation Tramways, 46, Bath Street, Glasgow. [T.A., Trams, Glasgow; T.N., Post Office 2218, 2214, 2215, Douglas; Nat. 1040, 1041, 1042, Douglas.] *Gen. Manager*, J. Dalrymple; *Traffic Supt.*, L. Mackinnon; *Chief Eng.*, J. Ferguson; *Elec. Eng.*, E. T. Goslin; *Sec.*, J. N. Wilson; *Chairman Try. Com.*, Bailie Kirkland; *Vice-Chairman*, Bailie Alston.

Gloucester Corporation Light Railway, Bristol Road Depôt, Gloucester. [T.A., Tramways, Gloucester; T.N. 155.] *Gen. Manager and Elec. Eng.* Leonard Johnston; *Chairman Try. Com.*, Ald. R. J. Talbot.

Great Yarmouth Corporation Tramways, Caister Road, Great Yarmouth. [T.N. 265.] *Gen. Manager*, F. L. Turner; *Elec. Eng.*, Gordon Bryant; *Per. Way. Eng.*, J. W. Cockrill (Borough Surveyor); *Chairman Try. Com.*, Ald. C. A. Campling; *Vice-Chairman*, Coun. J. T. C. Salmon.

Halifax Corporation Tramways, Skircoat Road, Halifax. [T.N., 86.] *Traffic Manager*, Jas. D. Caird; *Try. Eng.*, J. W. Galloway; *Per. Way Eng.*, J. Lord (Boro. Eng.); *Chairman Try. Com.*, Coun. C. F. Spencer; *Vice-Chairman* Coun. A. Fawcett.

Haslingden Corporation Tramways, John Street, Haslingden. *Gen. Manager and Elec. Eng.*, Barnes Kay; *Per. Way Eng.*, J. S. Green (Borough Surveyor); *Chairman Try. Com.*, Coun. Waddington; *Vice-Chairman*, Coun. Russell.

Herne Bay Pier Tramway (owned and worked by Herne Bay U.D.C.), Herne Bay. [T.N., 22.] *Res. Eng. and Manager*, H. C. Dufton.

Heywood Corporation Tramways, Heywood, Lancs. [T.N., 37.] *Gen. Manager*, J. Stott; *Per. Way Eng.*, J. A. Settle; *Chairman Try. Com.*, Coun. J. Ashworth; *Vice-Chairman*, Ald. T. Popple, J.P.

Huddersfield Corporation Tramways, Northumberland Street, Huddersfield. [T.N., 698 and 398.] *Gen. Manager & Elec. Eng.*, R. H. Wilkinson; *Traffic Supt.*, T. Hartley; *Borough Eng.*, K. F. Campbell; *Rolling Stock Supt.*, G. H. Lawton; *Chairman Try. Com.*, Ald. J. W. Aston; *Vice-Chairman*, Ald. J. Taylor.

Hull Corporation Tramways, Alfred Gelder St., Hull. [T.N., 443 & 444. Corporation.] *Manager*, Wm. J. McCombe; *Elec. Eng.*, J. Wilkinson; *Per. Way Eng.*, A. E. White; *Rolling Stock Supt.*, ; *Chairman Try. Com.*, Ald. Robson, J.P.; *Vice-Chairman*, Coun. Hargreaves, J.P.

Ilford Urban District Council Tramways, Ley Street, Ilford. [T.N., 684.] *Manager*, L. E. Harvey; *Traffic Manager*, A. Woolstencroft; *Works Supt.*, H. H. Simpson; *Chairman Try. Com.*, Coun. R. Stroud; *Vice-Chairman*, Coun. J. Deveson.

Ilkeston Corporation Tramways, Park Road, Ilkeston. [T.A., Bellamy, Ilkeston; T.N., 26.] *Manager and Elec. Eng.*, L. C. F. Bellamy; *Chairman Try. Com.*, Coun. W. Richards; *Vice-Chairman*, Coun. Shaw.

Ipswich Corporation Tramways, Constantine Road, Ipswich. [T.A., Ayton, Tramways, Ipswich; T.N., 354.] *Gen. Manager and Elec. Eng.*, Frank Ayton; *Traffic Supt.*, A. Butler; *Rolling Stock Supt.*, W. A. Fairhead; *Chairman Try. Com.*, Coun. E. C. Ransome *Vice-Chairman*, W. P. Burton.

Kearsley Urban District Council Tramways, Council Office, Kearsley, Farnworth, S.O. *Clerk U. D. C.*, H. Martin.

[Lines leased to and worked by the South Lancashire Tramways Co.]

Keighley Corporation Tramways, South Street, Keighley. [T.A., Tramways, Keighley; T.N., 17.] *Gen. Manager and Elec. Eng.*, H. Webber; *Chairman Try. Com.*, Coun. A. Smith.

Kilmarnock Corporation Tramways, Electricity Works, Kilmarnock. [T.N., 95.] *Elec. Eng. and Manager*, W. C. Bexon; *Consulting Engineers*, Kennedy and Jenkin; *Convener Try. Com.*, Coun. Finlay.

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Lancaster Corporation Tramways, Electricity Works, Lancaster. [T.A., Milnes, Tramways, Lancaster; T.N., 1, L.] *Gen. Manager & Elec. Eng.*, G. C. Milnes; *Traffic Manager*, W. T. Charlton; *Chairman Try. Com.*, Coun. T. Wilkinson.

Leeds City Tramways, Standard Buildings, City Square, Leeds. *General Manager*, J. B. Hamilton; *Traffic Supt.*, A. Daggett; *Elec. Eng.*, John Burbridge; *Per. Way Eng.*, R. B. Holt; *Car Works Supt.*, G. E. Watmough; *Chairman Try. Com.*, Ald. C. F. Tetley; *Vice-Chairman*, Ald. H. Brown.

Leicester Corporation Tramways, 20 and 22, Humberstone Gate, Leicester. [T.N., 409.] *Manager & Sec.*, A. F. Lucas; *Boro. & Try. Eng.*, E. G. Mawbey; *Elec. Eng.*, T. R. Smith; *Cons. Engs.*, Kincaid, Waller, & Manville; *Chairman Try. Com.*, Ald. S. Flint, J.P.; *Vice-Chairman*, Ald. G. Banton, J.P.

Leith Corporation Tramways, 165, Leith Walk, Leith. [T.N., 415.] *Gen. Manager*, F. A. Fitzpayne; *Per. Way Eng.*, J. R. Findlay (*Burgh Eng.*); *Chairman Try. Com.*, Judge Hall.

Leyton District Council Tramways, Car Depot, Lea Bridge Road, Leyton, E. [T.A., Tramways, Leyton; T.N., 17 Walthamstow.] *Manager*, F. Schofield; *Elec. Eng.*, F. Harman Lewis; *Per. Way Eng.*, E. H. Essex; *Chairman Try. Com.*, Coun. H. Heather.

Lincoln Corporation Tramways, Brayford Side North, Lincoln. [T.A., Stanley Clegg, Lincoln; T.N., 109]. *General Manager and Elec. Eng.*, Stanley Clegg; *Chairman Try. Com.*, Coun. W. S. White.

Liverpool Corporation Tramways, 24, Hatton Garden, Liverpool. [T.A., Tramways, Liverpool; T.N., 7701, Central.] *General Manager*, C. W. Mallins; *Resident Elec. Eng.*, Alfred Clough; *Per. Way Eng.*, J. A. Brodie; *Rolling Stock Supt.*, T. Ridyard; *Chairman Try. Com.*, Ald. F. Smith, J.P.; *Vice-Chairman*, Major R. J. Clarke.

London County Council Tramways, 62, Finsbury Pavement, London, E.C. [T.A., Lotram, London; T.N., 3321, 3322, and 3323 London Wall.] *Chief Officer*, A. L. C. Fell; *Deputy Chief Officer*, J. K. Bruce; *Elec. Assist.*, J. Shepherd; *Traffic Assist.*, L. Slattery; *Rolling Stock Supt.*, W. E. Ireland; *Per. Way Eng.*, J. Welling; *Chairman Highways Com.*, W. J. Squires; *Vice-Chairman*, T. C. E. Goff.

Lowestoft Corporation Tramways, Norwich Road, Lowestoft. [T.N., 87.] *Gen. Manager*, H. H. Saunders; *Elec. Eng.*, W. R. May; *Chairman Try. Com.*, Coun. F. Spashett.

Maidstone Corporation Tramways, Tramway Offices, Tonbridge Road Maidstone. [T.A., Lambert, Tramways, Maidstone; T.N., 72 B.] *Gen. Manager and Elec. Eng.*, A. T. Lambert; *Cons. Eng.*, S. Sellon; *Chairman Try. Com.*, Coun. Lyle; *Vice-Chairman*, Coun. Green.

Manchester Corporation Tramways, 55, Piccadilly, Manchester. [T.A., Tramways, Manchester; T.N., 6010 Central.] *Gen. Manager*, J. M. McElroy; *Traffic Sup.*, J. T. Oakes; *Elec. Eng.*, J. J. McMahon, *Per. Way Eng.*, H. Mattinson; *Rolling Stock Supt.*, G. R. Blackburn; *Chairman Try. Com.*, Ald. J. Bowes; *Vice-Chairman*, Coun. A. W. Chapman.

Middlesex County Council Light Railways, Middlesex Guildhall, Westminster, London, S.W. *County Eng.*, H. T. Wakelam, M.I.C.E.; *Chairman of Light Railways Com.*, County Ald. H. Burt; *Vice-Chairman*, County Ald. C. Pinkham.

Middleton Corporation Tramways. *Consulting Engs.*, Lacey, Sillar, and Leigh; *Chairman Try. Com.*, Coun. W. Wood, J.P.; *Vice-Chairman*, Ald. Bentley, J.P.
[Worked by Manchester Corporation Tramways.]

Nelson Corporation Light Railways, Charles Street, Nelson. [T.N., 115.] *Manager and Elec. Eng.*, G. F. Taylor; *Per. Way Eng.*, W. Shackleton; *Chairman Try. Com.*, Coun. W. F. Cooke.

Newcastle-upon-Tyne Corporation Tramways, Manors, Newcastle. [T.A., Traction, Newcastle; T.N., 913 & 914 Nat., 241 P.O.] *Gen. Manager & Engineer*, Ernest Hatton; *Traffic Supt.*, T. Chalder; *Per. Way Eng.*, W. J. Steele; *Chairman Try. Com.*, Coun. J. H. Rodgers; *Vice-Chairman*, Coun. R. Mayne.

Newport (Mon.) Corporation Tramways, Town Hall, Newport, Mon. [T.A., Dynamo, Newport, Mon.; T.N., 990 L., Nat.] *Gen. Manager*, N. J. Young; *Boro. Elec. and Per. Way Eng.*, A. Nichols Moore; *Chairman Try. Com.*, Coun. J. Moxon; *Vice-Chairman*, Ald. F. Phillips.

Northampton Corporation Tramways, St. James', Northampton. [T.N., 248.] *Gen. Manager*, J. Gottschalk; *Elec. Eng.*, J. F. Cameron; *Chairman Try. Com.*, Coun. T. D. Lewis.

Nottingham Corporation Tramways, Beastmarket Hill, Nottingham. [Tramways, Nottingham; T.N., 225.] *General Manager & Elec. Eng.*, John Aldworth; *Traffic Supt.*, H. Morley; *Per. Way Eng.*, Arthur Brown (*City Eng.*); *Rolling Stock Supt.*, W. Boot; *Chairman Try. Com.*, Coun. R. H. Swain; *Vice-Chairman*, Ald. F. R. Radford.

Oldham Corporation Tramways, Wallshaw Depot, Oldham. [T.A., Tramways, Oldham; T.N., 374.] *Gen. Manager & Eng.*, J. W. Dugdale; *Traffic Supt.*, W. T. Young; *Chairman Try. Com.*, Coun. Isherwood; *Vice-Chairman*, Coun. F. Elliot.

Perth Corporation Tramways, Electricity Works, Perth. [T.N., 226 & 101.] *Tramways Manager*, W. G. Snell; *Elec. & Tramways Eng.*, John Lambert; *Per. Way Eng.*, R. McKillop (*Burgh Surv.*); *Chairman Try. Com.*, Coun. Moncrieff.

Plymouth Corporation Tramways, 15, Ebrington Street, Plymouth. [T.N. 518, Plymouth.] *General Manager*, C. R. Everson; *Elec. Eng.*, E. J. Okell; *Chairman Try. Com.*, Ald. Philips, J.P.

Pontypridd Urban District Tramways, Generating Station, Treforest, Pontypridd. [T.N. 33.] *Gen. Manager and Elec. Eng.*, J. E. Teasdel; *Traffic Inspector*, W. May; *Per. Way Eng.*, W. E. Lowe (*Surveyor*); *Chairman Try. Com.*, Coun. W. J. Davies.

Portsmouth Corporation Tramways, Town Hall, Portsmouth. [T.N., 110 Corporation.] *Gen. Manager*, W. R. Spaven; *Elec. and Per. Way Eng., and Rolling Stock Supt.*, V. G. Lironi; *Traffic Supt.*, W. Munford; *Chairman Try. Com.*, Ald. J. H. Corke, J.P. (Mayor); *Vice-Chairman*, Coun. J. Timpson.

Preston Corporation Tramways, Holmrook Road, Preston. [T.A., Corporation Tramways, Preston; T.N., 273.] *Gen. Manager and Elec. Eng.*, J. F. Simpson; *Traffic Supt.*, E. Lafferty; *Chairman, Try. Com.*, Coun. S. Crompton; *Vice-Chairman*, Ald. J. Ormrod.

Radcliffe Urban District Council Tramways, Council Offices, Radcliffe, Lancs. *Res. Eng.*, H. Wilkinson; *Per. Way Eng.*, W. L. Rothwell; *Clerk*, S. Mills; *Chairman Try. Com.*, Coun. Walker Allen, J.P.
[These tramways are worked as part of the Bury system.]

Rawtenstall Corporation Tramways, Bacup Road, Rawtenstall. [T.N., 81 and 85.] *Gen. Manager and Elec. Eng.*, C. L. E. Stewart; *Chairman Try. Com.*, Ald. H. Coupe, J.P.; *Vice-Chairman*, Coun. Grimshaw.

Reading Corporation Tramways, Mill Lane, Reading. [T.A., Tramways Manager, Reading; T.N., 330.] *Gen. Manager & Elec. Eng.*, G. F. Craven; *Chairman Try. Com.*, Ald. C. G. Field, J.P. (Mayor).

Rochdale Corporation Tramways, Mellor Street, Rochdale. [T.A., Tramways, Rochdale; T.N., 48.] *Gen. Manager & Eng.*, J. S. D. Moffet; *Traffic Manager*, G. Webster; *Rolling Stock Supt.*, E. Sidgewick; *Chairman Try. Com.*, Coun. Fielden.

Rotherham Corporation Tramways, Rawmarsh Road, Rotherham. [T.A., Cross, Rotherham; T.N., 138, 152, and 241.] *General Manager & Elec. Eng.*, E. Cross; *Deputy Elec. Eng.*, J. Williams; *Traffic Manager*, H. Jagger; *Per. Way Eng.*, E. B. Martin; *Rolling Stock Supt.*, C. A. Walker; *Chairman Try. Com.*, Ald. D. L. Winter; *Vice-Chairman*, Coun. T. Reeves.

St. Helens Corporation Tramways, Town Hall, St. Helens, Lancs. *Chairman Try. Com.*, Ald. Sir J. Beecham; *Vice-Chairman*, Coun. W. N. Pilkington.
[Lines worked by the New St. Helens and District Tramways Co.]

Salford Corporation Tramways, 32, Blackfriars Street, Salford. [T.A., Tramways, Salford; T.N., 5967 and 5368 Central.] *Gen. Manager*, Geo. W. Holford; *Elec. Eng.*, H. J. Hawkins; *Traffic Supt.*, C. H. Chester; *Per. Way Supt.*, H. Richardson; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Ald. H. Linsley, J.P.; *Vice-Chairman*, Coun. A. Stringfellow.

Sheffield Corporation Tramways, 8, Division Street, Sheffield. [T.A., Tramways, Sheffield; T.N., 2470 and 3552.] *General Manager*, A. R. Fearnley; *Elec. Eng.*, H. E. Yerbury; *Traffic Supt.*, A. Handford; *Per. Way. Eng.*, W. J. Hadfield; *Rolling Stock Supt.*, J. Smith; *Chairman Try. Com.*, Ald. Sir W. E. Clegg, J.P.; *Vice-Chairman*, Coun. A. T. Bescoby, J.P.

Shipley Urban District Tramway, Dockfield, Shipley. [T.A., Electricity Works, Shipley; T.N., 190.] *Elec. Eng.*, ; *Chairman Try. Com.*, H. Pitts.
[Lines leased to Bradford Corporation.]

Southampton Corporation Tramways, 161 Above Bar, Southampton. [T.A., Tramways, Southampton; T.N., 301.] *Gen. Manager and Boro. Elec. Engineer*, H. F. Street; *Traffic Manager*, C. G. Simpson; *Chairman Try. Com.*, Ald. F. A. Dunsford, J.P.

Southend-on-Sea Corporation Tramways, London Road, Southend-on-Sea. [T.N., 96.] *Gen. Manager and Elec. Eng.*, R. Birkett; *Traffic Manager*, J. Daniells,; *Per. Way Eng.*, E. J. Elford (*Boro. Surveyor*); *Rolling Stock Supt.*, J. Dobson; *Chairman Try. Com.*, Ald. A. Martin.

Southend Pier Electric Railway, (owned and worked by Southend-on-Sea Corporation), [T.A., Piermaster, Southend; T.N., 91.] Southend-on-Sea. *Elec. Eng.*, C. R. Norton; *Piermaster*, Capt. N. E. Hucker; *Chairman*, Coun. H. Dowsett.

Southport Corporation Tramway, 44, Chapel Street, Southport. [T.N., 116.] *Gen. Manager*, T. J. Kendrew; *Boro' Elec. Eng.*, A. S. Black; *Chairman Try. Com.*, Coun. R. Morrin; *Vice-Chairman*, Ald. S. Ingham.

South Shields Corporation Tramways, Dean Road, South Shields. [T.A., Tramways, South Shields; T.N., 157.] *Gen. Manager & Elec. Eng.*, W. T. Robson; *Boro. Elec. Eng.*, H. S. Ellis; *Chairman Try. Com.*, Ald. W. G. Wylie; *Vice-Chairman*, Coun. J. W. Henderson.

Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board, Waterloo Road, Stalybridge. [T.N., 311.] *Commercial Manager*, F. Schofield; *Chief Eng.*, R. Blackmore; *Chairman Try. Com.*, Ald. J. Clark, J.P.; *Vice-Chairman*, Ald. R. Wood.

Stockport Corporation Tramways, Mersey Square, Stockport. [T.N., 232 and 237.] *Manager*, A. T. Eardley; *Elec. Eng.*, R. Lomax; *Chairman Try. Com.*, Ald. Chas. Sharples; *Vice-Chairman*, Ald. W. E. Hampett.

Sunderland Corporation Tramways, Tramway Offices, Monkwearmouth, Sunderland. [T.A., Trys. Manager, Sunderland; T.N., 948.] *Gen. Manager and Elec. Eng.*, A. R. Dayson; *Chairman Try. Com.*, Coun. G. New, J.P.; *Vice-Chairman*, Coun. W. Walker.

Swindon Corporation Tramways, Electricity Works, Swindon. [T.A., Tramways, Swindon; T.N., 28 and 4.] *Manager*, T. Medcalf; *Elec. Eng.*, A. Dimmack; *Consulting Engs.*, Lacey, Sillar, & Leigh; *Chairman Try. Com.*, Coun. Marillier; *Vice-Chairman*, Coun. Gilbert.

Wallasey Corporation Tramways, Seaview Road, Wallasey. [T.A., Tramways, Liscard T.N., 439, Liscard.] *General Manager*, R. R. Greene; *Elec. Eng.*, J. H Crowther; *Per. Way Eng.*, W. H. Travers; *Chairman Try. Com.*, Coun. J. Farley; *Vice-Chairman*, Coun. F. E. Howse.

Walsall Corporation Tramway, Birchills Depot, Bloxwich Road, Walsall. [T.A., Tramways, Walsall; T.N., 264.] *Gen. Manager*, R. L. Horsfield; *Elec. Eng.*, A. S. Barnard; *Per. Way Eng.*, J. Taylor (*Boro. Surveyor*); *Chairman, Try. Com.*, Ald. J. Cope; *Vice-Chairman*, Coun. J. Williams.

Walthamstow Urban District Council Tramways, Chingford Road, Walthamstow, [T.A. Tramways, Walthamstow; T.N., 20.] *Tramways Manager*, W. Murray; *Elec. Eng.*, G. R. Spurr (Priory Avenue, Walthamstow); *Per. Way Eng.*, G. W. Holmes; *Chairman Trys. Com.*, Coun. R. J. Bishop.

Warrington Corporation Tramways, Mersey Street, Warrington. [T.N., 196] *Gen. Manager*, J. Telfer; *Elec. Eng.*, F. V. L. Mathias; *Chairman Try. Com.*, Ald. Jas. Smethurst; *Vice-Chairman*, Coun. Wilkinson.

West Bromwich Corporation Tramway, Electricity Works, West Bromwich. [T.N., 100.] *Boro. Eng.*, A. D. Greatorex; *Boro. Elec. Eng.*, W. A. Jackson; *Chairman Try. Com.*, Ald. A. G. Turley, J.P.; *Vice-Chairman*, Coun. G. Garratt, J.P.
[These tramways are leased to the South Staffs. (Lessee) Co., Ltd.]

West Ham Corporation Tramways, Greengate Street, Plaistow, London, E. [T.A., Trameurs, London; T.N., 868 East.] *General Manager*, H. E. Blain; *Boro' Elec. Eng.*, J. W. Beauchamp; *Per. Way Eng.*, J. G. Morley (*Boro. Eng.*); *Chairman Try. Com.*, Ald. H. W. Littler.

West Hartlepool Corporation Tramways, Cleveland Road, West Hartlepool. [T.N., 6073.] *Gen. Manager & Eng.*, Chas. Burgess; *Chairman Try. Com.*, Coun. W. Paterson; *Vice-Chairman*, Coun. Martin (Mayor).

Wigan Corporation Tramways, Bradford Place, Wigan. [T.A., Trolley, Wigan; T.N., 162.] *Gen. Manager and Elec. Eng.*, James Slevin; *Traffic Manager*, F. Buckley; *Per. Way Eng.*, W. Bolton; *Chairman Try. Com.*, Ald. T. Ashton; *Vice-chairman*, Coun. J. Bradshaw.

Wolverhampton Corporation Tramways, Municipal Tramway Offices, Cleveland Road, Wolverhampton. [T.N., 324.] *Gen. Manager*, W. A. Luntley; *Chief Assistant and Eng.*, C O. Silvers; *Elec. Eng.*, S. T. Allen; *Per. Way Eng.*, George Green; *Chairman Try. Com.*, Ald. Sir C. T. Mander, Bart., J.P.; *Vice-Chairman*, Ald. S. Craddock, J.P.

York Corporation Tramways, 8, Clifford Street, York. [T.N., 302]. *Gen. Manager and Elec. Eng.*, J. W. Hame; *Per. Way Eng.*, F. W. Spurr (City Surveyor); *Chairman Try. Com.*, Ald. S. W. Meyer; *Vice-Chairman*, Coun. S. H. Davies.

COMPANY TRAMWAYS.

Aberdeen Suburban Tramways Company, 15, Golden Square, Aberdeen. [T.A., Judicial, Aberdeen; T.N., 447.] *Managing Director and Per. Way Eng.*, A. Wilkie; *Traffic Inspector*, W. Kerr; *Elec Eng.*, J. Ross; *Sec.*, G. Duncan; *Chairman*, G. J. Walker; *Directors*, W. Jackson, Dr. Christie, A. Wilkie, J. Mearns.

Airdrie and Coatbridge Tramways Company, Tramway Depôt, Main Street, Coatbridge [T.N., 105], and Electrical Federation Offices, Kingsway, London, W.C. *Gen. Manager*, A. Robertson; *Sec.*, W. F. Herring; *Chairman*, W. L. Madgen; *Directors*, H. S. Day, A. C. Miles, C. Sherriff Hilton.

Barnsley and District Electric Traction Company, Ltd., Car Depot, Sheffield Road, Barnsley. [T.A., Tramways, Barnsley; T.N., 159.] *Manager and Eng.*, P. H. Marco; *Sec.*, S. M. Wright; *Chairman*, E. Garcke; *Directors*, Col. Sir Thomas Pilkington, Bart., E. A. Paris.

Barrow-in-Furness Tramways, Salthouse Road Depot, Barrow, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Barrow; T.N., 125, Nat.] *Manager*, W. F. Bladon; *Sec.*, C. H. Godward; *Chairman*, S. Day; *Director*, J. V. Kitchener.

Bath Electric Tramways Company, Ltd., Walcot Street, Bath, and 119-125, Finsbury Pavement, London, E.C. [T.A., Trams, Bath; T.N., 214.] *Gen. Manager and Eng.*, W. E. Hardy; *Traffic Supt.*, E. Seckington; *Sec.*, H. J. Almond; *Chairman*, Hon. Sir J. Sivewright, K.C.M.G.; *Directors*, H. F. Clutterbuck, E. H. R. Trenow, A. A. C. Swinton, E. Callaird.

Bessbrook and Newry Tramway Company, Bessbrook, Co. Armagh. [T.A., Tramways, Bessbrook.] *Manager*, Robert Caven; *Elec. Eng.*, J. L. D. Meares; *Chairman*, J. N. Richardson; *Directors*, C. H. Richardson, R. T. Scott, J. W. Richardson, T. McGreggor Greer.

Birmingham and Midland Tramways, Ltd., Power Station, Downing Street, Smethwick, Birmingham, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick, 368 Central, Birmingham.] *Electrical Eng.*, S. A. Mahood; *Gen. Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, C. Shirreff Hilton; *Directors*, J. A. Lycett, W. L. Madgen, S. R. Blundstone.

Blackpool and Fleetwood Tramroad Company, Ltd., Bispham, near Blackpool. [T.A., Cameron, Blackpool; T.N., 124.] *General Manager and Secretary*, J. Cameron; *Elec. Eng.*, A. Cameron; *Chairman*, George Richardson; *Directors*, R. H. Prestwich, R. B. Barningham, R. S. Boddington J. Greenwood, G. Readman.

(*Continued on page xxix.*)

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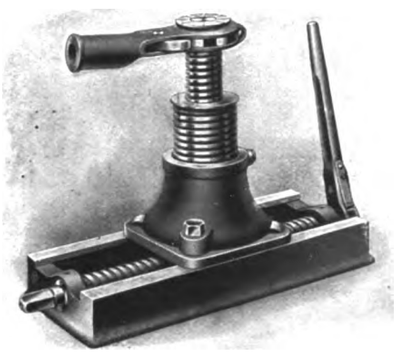

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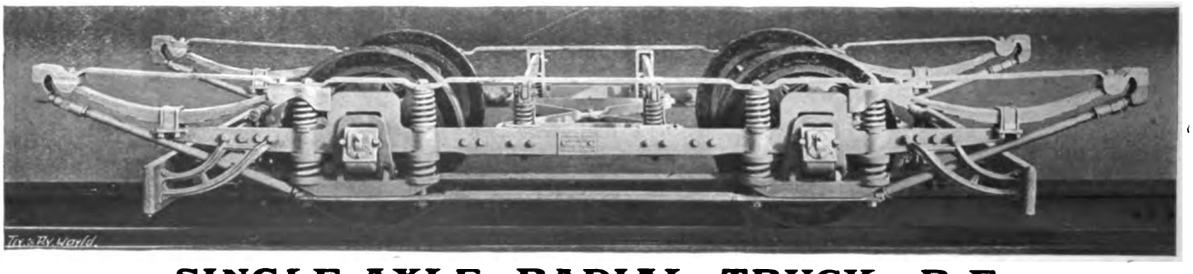

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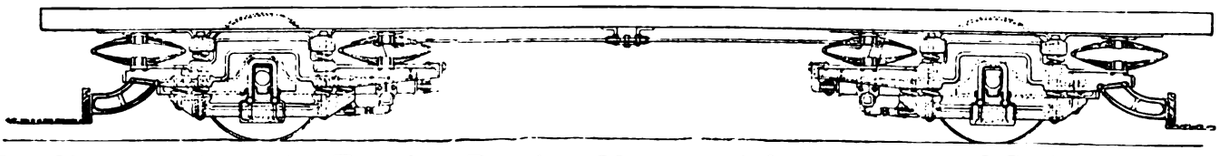

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Blackpool, St. Anne's, and Lytham Tramways Company, Ltd., Squires Gate, and 30, Birley Street, Blackpool. [T.N., 327 and 421]. *Gen. Manager and Elec. Eng.*, H. W. Laing; *Traffic Manager*, G. W. Wood; *Rolling Stock Supt.*, J. Partington; *Secretary*, Chas. E. Riding; *Chairman*, Thos. Blane; *Directors*, T. M. Smith, G. Nicholson.

Bray and Enniskerry Railway Company, 52, Westland Row, Dublin. *Sec.*, M. F. Keogh; *Chairman*, A. Killingley; *Director*, F. M'Crea.

Brighton Beach Electric Railway, Madeira Road, Brighton. [T.A., Volk, Brighton; T.N., 14 P.O.] *Manager and Eng.*, M. H. Volk; *Traffic Clerk*, H. Sheppard; *Per. Way Eng.*, J. Barker; *Secretary*, A. Volk; *Chairman*, M. Volk; *Director*, M. H. Volk.

Bristol Tramways and Carriage Company, Ltd., Clare Street House, Bristol. [T.A., Cab, Bristol; T.N., 74 & 3074 Nat.] *Manager*, Chas. Challenger; *Assist. Manager*, S. E. Smith; *Electrical Engineer*, W. H. Munton; *Permanent Way Engineer*, G. T. C. Edwards; *Secretary*, H. F. Cooper; *Chairman*, Sir G. White, Bart.; *Directors*, S. White, J.P. (*Managing*), J. H. Howell, J.P., Hugh G. Doggett.

British Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. E. Garcke (*chairman and managing director*); *Directors*, P. D. Tuckett, C. Shirreff B. Hilton, J. S. Raworth, W. L. Madgen, G. Cornwallis West; *Secretary*, C. H. Dade; *Accountant*, C. Walmsley.

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Barnsley & District.	Merthyr.
Barrow-in-Furness.	Metropolitan.
Birmingham & Midland Trys. Joint Com.:	Middleton.
Birmingham & Midland	Oldham, Ashton, & Hyde.
City of Birmingham.	Peterborough.
Dudley, Stourbridge, & District.	Potteries.
South Staffordshire.	Rothesay.
Wolverhampton Dist.	Sheerness & District.
Cavehill & Whitewell.	South Metropolitan.
Devonport & District.	Southport.
Gateshead & District.	Swansea.
Gravesend & Northfleet.	Taunton.
Greenock & Port Glasgow.	Tynemouth & District.
Hartlepool.	Weston-super-Mare & District.
Jarrow & District.	Worcester.
Kidderminster & Stourport.	Wrexham & District.
	Yorkshire (Woollen Dist.)

Burton and Ashby Light Railways, Power Station, Swadlincote, nr. Burton-on-Trent. [T.A., Light Railway, Swadlincote; T.N., 1.] *Manager and Eng.*, Jas. Toulmin; *Secretary*, A. L. Charles; *Chairman*, G. Murray Smith.

[The line is owned and worked by the Midland Railway Company.]

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Carlisle Tramways Company, Ltd., City of, 1, Warwick Road, Carlisle. [T.N., 0180.] *Engineer and Manager*, E. W. Sleight.

Cavehill and Whitewell Tramway Company, Electrical Federation Offices, Kingsway, London, W.C. *Secretary*, W. Rodden; *Chairman*, W. Armstrong; *Directors*, R. Dunlop, R. B. Park, A. H. Beatty, C. H. Dade.

Chatham and District Light Railways Company, Luton Road, Chatham, and 83, Cannon Street, London, E.C. [T.A., Tramways, Chatham; T.N., 51.] *General Manager*, W. Jensen; *Assist. Manager*, J. C. Whiteley; *Traffic Manager*, W. G. Davis; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, H. C. Levis, J. F. Nauheim, W. B. H. Martindale.

Cheltenham and District Light Railway Company, St. Mark's, Cheltenham. [T.A., Trams, Cheltenham; T.N., 341.] *Gen. Manager, Eng., and Sec.*, H. J. McCormick; *Chairman*, Thomas A. Nevins; *Directors*, H. V. Jackson, H. J. McCormick, W. G. Gurney, J. Batten Winterbotham.

City of Birmingham Tramways Company, Ltd. (Section of Birmingham and Midland Joint Committee Tramways). Power Station, Downing Street, Smethwick, Birmingham, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick, 368 Central, Birmingham; *Gen. Manager*, W. G. Bond; *Secretary*, T. Bower; *Directors*, E. Garcke (*Chairman*), J. A. Christie, G. C. Cuningham, C. S. B. Hilton, J. A. Lycett (*Managing*).

Clontarf and Hill of Howth Tramroad Company, 39, Dame Street, Dublin. [T.A., c/o Railways, Dublin; T.N., 917.] *Secretary*, J. P. Chapman; *Chairman*, W. L. Murphy; *Directors*, E. Anderson, J. J. Dudley.

Colne and Trawden Light Railways Company, Keighley Road, Colne, Lancs. [T.A., Trams, Colne; T.N., 30.] *Gen. Manager and Eng.*, M. Turner; *Secretary*, J. B. Peck, 84, Armley Road, Leeds; *Chairman*, H. Copperthwaite; *Directors*, H. W. Coleman, H. Greenwood, A. G. Hopper, S. Batley; J. T. Landless.

Cork Electric Tramways and Lighting Company, Ltd., Albert Street, Cork. [T.A., Tramways, Cork; T.N., 78 and 535.] *Manager and Engineer*, H. H. Nalder; *Traffic Manager*, H. G. Whiting; *Per. Way Engineer*, H. Mack; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, E. Anderson, W. M. Murphy, W. B. H. Martindale, H. C. Levis.

Dartford Urban District Council Tramways, Car Depot, Priory Road, Dartford. [T.N., 31 Dartford.] (Leased to and worked by Balfour, Beatty, & Co., Ltd., 22a, College Hill, London, E.C.) *Gen. Manager and Engineer*, Stanley Dudman.

Devonport and District Tramways Company, Ltd., Tramway Depot., Milehouse, Devonport, and Electrical Federation Offices, London, W.C. [T.A., Head Office, Devonport c/o Tramway, London; T.N., Head Office, Holborn 2686. T.A., Tramways, Milehouse, Devonport; T.N., 62.] *Manager and Eng.*, George Cardwell; *Secretary*, S. M. Wright; *Chairman*, C. S. B. Hilton; *Directors*, J. S. Raworth, E. R. Soames.

Dewsbury, Batley, and Birstall Tramways Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C.

[Lines worked by Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Douglas—Ramsey. (The Manx Elec. Rly. Company), 1, Strathallan Crescent, Douglas. (See Manx Electric Railway Company).

Douglas Southern Electric Tramways, Ltd., Marine Drive, Douglas, Isle of Man, and 24, Brazennose Street, Manchester. [T.A., Traffic, Douglas.] *Manager and Eng.*, R. Orton; *Sec.*, J. E. Sharples; *Chairman*, T. J. Hutchinson; *Directors*, I. E. Winslow, E. A. Hopkins.

Dublin and Lucan Electric Railway Company, 15, Conyngham Road, Dublin. [T.A., Lucan Tramway, Dublin; T.N. 2282 Dublin and 5 Lucan.] *Manager, Elec. Eng., and Sec.*, D. McDowall Grosart; *Rolling Stock Supt.*, R. O'Toole; *Chairman*, Wm. Mooney; *Directors*, J. W. Hill, Capt. C. C. Vesey, E. Anderson.

Dublin United Tramways Company (1896), Ltd., 9, Upper Sackville Street, Dublin. [T.A., Tramways, Dublin; T.N., 58 and 59.] *Manager*, C. W. Gordon; *Elec. Eng.*, G. M. Harris; *Con. Eng.*, H. F. Parshall; *Per. Way Eng.*, P. F. O'Sullivan; *Secretary*, R. S. Tresilian; *Chairman*, W. M. Murphy; *Directors*, W. F. Cotton, Capt. C. N. Colthurst Vesey, J. Mooney.

Dudley, Stourbridge and District Electric Traction Company, Ltd. (Section of The Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, Birmingham, Brierley Hill, Staffs., and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick; 368 Central, Birmingham.] *General Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, W. G. Bond.

Dumbarton Burgh and County Tramways Company, Tramway Depot, Dumbarton, and 28, Rutland Street, Edinburgh. [T.A., Tramways, Dumbarton; T.N., 119.] *Gen. Manager and Elec. Eng.*, J. P. McMahon; *Secretary*, J. Dishart; *Chairman*, G. Balfour; *Directors*, K. Sanderson, K. A. Scott Moncrieff.

Dundee, Broughty Ferry & District Tramways Company, Milton, Monifieth, N.B. [T.N., 24 Monifieth.] *Gen. Manager & Engineer*, Daniel Fisher; *Secretary*, E. Cowan; *Chairman*, W. Brownlee; *Directors*, Geo. Balfour, D. W. Wybrants, David Hynds.

Dunfermline and District Tramways Company, Tramway Depot, Cowdenbeath, Fife, and Commercial Bank Buildings, High Street, Dunfermline. *Manager and Engineer*, J. H. Shepherd; *Secretary*, G. A. Nicolson; *Cons. Engs.*, Hawtayne & Zeden; *Directors*, Wm. Low, G. Balfour (*managing*), K. Sanderson, D. Hynd.

Falkirk & District Tramways Company, Larbert Road, Larbert, Stirlingshire. [T.A., Tramway Co., Falkirk; T.N., 154 Falkirk.] *Gen. Manager and Secretary*, D. Hays; *Chairman*, G. M. Brown; *Directors*, A. W. Tait, R. Hunter, G. Balfour.

Felixstowe Pier Railway, Felixstowe. (The Coast Development Corporation, Ltd.) *Elec. Eng.*, E. A. Lambert.

Gateshead and District Tramway Company, Tramway Depôt, Sunderland Road, Gateshead, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depôt, Gateshead; T.N., 125 & 408 Gateshead National.] *Manager*, William Morrison; *Secretary*, H. S. Stagg; *Chairman*, C. R. Greene; *Directors*, C. S. B. Hilton (*deputy chairman*), L. A. Atherley-Jones, H. S. Day.

Giant's Causeway and Portrush Electric Tramway Company, Portrush. *Manager & Sec.*, D. Fall; *Elec. Eng.*, W. A. Traill; *Chairman*, A. Traill; *Directors*, C. M'D. Stuart, J. S. Moore, W. A. Traill.

Glossop Urban District Tramways, Electricity Works, Glossop (leased and worked by the Urban Electric Supply Co.) [T.N., 34, Glossop.] *Manager and Res. Eng.*, C. E. Knowles; *Rolling Stock Supt.*, A. W. Bullough; *Secretary*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, F. E. Gripper, H. B. Grotrian, D. Owen.

Gosport and Fareham Tramways, Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, National, Gosport, and 16, Municipal, Gosport.] *Eng. and Manager*, J. Fereday Glenn; *Cons. Eng.*, J. Glenn; *Sec.*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*managing*), John Glenn, S. Hern.

Gravesend & Northfleet Electric Tramways, Ltd., Tramway Depot, Northfleet, Kent, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 958, Gravesend.] *Gen. Manager & Sec.*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, J. F. Albright, W. S. Wreathall.

Great Crosby Tramways, 31, James Street, Liverpool.

[This tramway is worked by the Liverpool Overhead Railway Company.]

Great Grimsby Street Tramway Co., Southampton House, Cleethorpes, and Moorgate Station Chambers, London, E.C. [T.A., Blanco, Cleethorpes; T.N., 16.] *Manager and Eng.*, H. L. White; *Cons. Eng.*, J. Glenn; *Elec. Eng.*, H. O. White; *Managing Director and Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, S. Hern, John Glenn, J. Barber Glenn.

Greenock and Port Glasgow Tramways Company, Ladyburn, Greenock, and Electrical Federation Offices, Kingsway, London, W.C. [T.A. Tramways, Ladyburn, Greenock; T.N., 159]. *Manager*, A. Robertson; *Secretary*, W. F. Herring; *Chairman*, W. L. Madgen; *Directors*, C. S. B. Hilton, A. C. Miles, H. S. Day.

Guernsey Railway Company, Ltd., Hougue-à-la-Perre, Guernsey. *Manager and Elec. Eng.*, Arthur G. Bird; *Sec.*, J. de Mouilpied; *Chairman*, G. F. Peek; *Directors*, W. D. Murdoch, E. Valkied, T. Stedman, J. B. Collings.

Hampshire Light Railway (Electric) Company, Ltd., Moorgate Station Chambers, London, E.C. *Gen. Manager & Elec. Eng.*, J. Fereday Glenn; *Secretary*, J. B. Glenn; *Con. Eng.*, John Glenn; *Chairman*, A. Beattie, J.P.; *Directors*, J. Barber Glenn (*managing*), S. Hern, John Glenn.

Hastings Tramways Company, Ltd., Beaufort Road, Silverhill, St. Leonards-on-Sea, and 1, Queen Victoria Street, London, E.C. [T.A., Tramways, Hastings, and Enshrine, London; T.N., 90 Hastings, and 715, Bank]. *General Manager and Elec. Eng.*, T. B. Holliday; *Secretary*, W. R. Elston; *Cons. Engs.*, Kincaid, Waller, Manville, and Dawson; *Per. Way Eng.*, F. P. Holliday; *Rolling Stock Supt.*, R. W. Francis; *Chairman*, E. C. Morgan; *Directors*, G. Kitchin, J. C. Williamson, Dr. Mooney.

Imperial Tramways Company, Ltd., Clare Street House, Bristol. *Secretary*, W. G. Verdon Smith; *Superintendent*, F. Freshwater; *Resident Engineer*, A. W. Barnley; *Chairman*, Sir George White, Bart.; *Directors*, H. C. Godfray, Hugh G. Doggett, S. White.

Isle of Thanet Electric Tramways and Lighting Company, Ltd., St. Peter's, Kent, and Moorgate Station Chambers, London, E.C. [T.A., Tramways, St. Peters, Kent; T.N., 29 Broadstairs]. *Gen. Manager and Elec. Eng.*, J. A. Forde; *Traffic Supt.*, A. L. Gardener; *Per. Way Eng.*, W. Paterson; *Secretary*, J. Barber Glenn; *Chairman*, Lord Arthur Butler; *Directors*, W. M. Murphy, H. Brown, A. R. Monks.

Jarrow and District Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.A., Jarrow, c/o Tramway, London; T.N., 6822 Gerrard.] *Managing Director*, W. Morrison; *Traffic Manager*, G. McClelland; *Secretary*, C. W. Francis; *Chairman*, G. J. Somerville; *Directors*, W. Morrison (*managing*), C. S. B. Hilton.

Kidderminster and Stourport Electric Tramway Company, Kidderminster and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 108]. *Manager and Elec. Eng.*, A. Charlton; *Secretary*, B. Kingsford; *Chairman*, C. S. B. Hilton; *Directors*, J. A. Lycett (*managing*), S. E. Garcke.

Kinver Tramway, Kinver, and Electrical Federation Offices, Kingsway, London, W.C., *q.v.*, Dudley, Stourbridge, and District Elec. Traction Co., Ltd.

Lanarkshire Tramways Company, Edinburgh Road, Motherwell, N.B., and 83, Cannon Street, London, E.C. [T.A., Tramways, Motherwell; T.N., 64.] *Gen. Manager and Eng.*, G. F. Moller; *Elec. Eng.*, E. H. Glennie; *Per. Way Eng.*, R. Foster; *Traffic Supt.*, I. L. White; *Sec.*, A. Clements; *Chairman*, A. R. Monks; *Directors*, Sir B. Cunard, H. C. Levis, W. H. Whaite, G. Franklin, J. F. Nauheim.

Lancashire United Tramways Limited, Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36, Atherton.] *Engineer-in-Chief and Gen. Manager*, E. H. Edwardes; *Secretary*, H. P. Conibear; *Chairman*, Hon. A. Stanley, M.P.; *Directors*, J. M. Henderson, M.P., J. Beecham, J.P., R. Watson, J.P., A. Adam, J. S. Austen.

Leamington and Warwick Electrical Company, Ltd., Tramway Depôt, Emscote, Warwick, and Electrical Federation Buildings, Kingsway, London, W.C. *General Manager*, R. L. McCulloch; *Secretary*, W. E. Bennett; *Chairman*, E. Garcke; *Directors*, J. A. Lycett, J. W. Mann, S. E. Garcke.

Liverpool and Prescot Light Railway.—This line, which with the St. Helens Tramways forms the connecting link between the City of Liverpool and South Lancashire Tramways, is owned and worked by the Lancashire United Tramways, Ltd.

Liverpool Overhead Railway Company, 31, James Street, Liverpool. [T.A., Motor, Liverpool; T.N., 5463 Central.] *Gen. Manager and Eng.*, E. J. Neachell; *Secretary*, W. H. Alexander; *Chairman*, Sir W. B. Forwood; *Directors*, G. H. Robertson, H. C. Woodward, J. E. Anderson, G. D. Killey.

Llandudno and Colwyn Bay Electric Railway, Limited, Tramway Depôt, Rhôs-on-Sea, Colwyn Bay, and Basildon House, Moorgate Street, London, E.C. *Gen. Manager*, Alex. G. Balfour; *Secretary*, A. W. R. Lovering; *Directors*, G. Balfour, A. W. Tait, T. Stoker.

London United Tramways Ltd., Electrical Federation Buildings, Kingsway, London, W.C. *Managing Director*, J. Devonshire; *Secretary*, A. L. Barber; *General Manager*, Z. E. Knapp; *Chairman*, W. M. Acworth; *Directors*, Hon. Sidney Holland, A. H. Stanley, F. V. Schuster.

Luton Corporation Tramways (leased to and worked by Balfour, Beatty & Co., Ltd., 22a, College Hill, London, E.C.), Tramway Offices, Park Street, Luton. [T.N., 230.] *Engineer and Manager*, E. J. Vaughan.

Mansfield & District Light Railway Co., Sutton Road, Mansfield. [T.A., Cars, Mansfield. T.N., 107.] *Gen. Manager and Sec.*, C. R. Walker; *Chairman*, A. R. Holland; *Directors*, W. I. Chadburn, A. H. Beatty, G. Balfour.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM.

Manx Electric Railway Company, Ltd., 1, Strathallan Crescent, Douglas, Isle of Man, and 3, Finch Lane, London, E.C. [T.A., Electric, Douglas, Man.; T.N., 61.] *Gen. Manager & Eng.*, F. Edmondson; *Secretary*, C. A. Huni; *Chairman*, Sir A. Griffith Boscawen; *Directors*, Sir W. H. Vaudrey, B. E. Greenwell, E. Schenk.

Merthyr Electric Traction and Lighting Company, Ltd., 53, Pontmorlais Circus, Merthyr, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Company, Merthyr; T.N., Nat. 0180, Merthyr Tydfil.] *Managing Eng.*, L. W. Dixon; *Traffic Supt.*, H. King; *Sec.*, S. G. Clements, *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, W. L. Madgen, G. R. Soames.

Metropolitan Electric Tramways, Limited, Electrical Federation Offices, Kingsway, London, W.C. [T.A., Metrolito, London; T.N., 2686, Holborn.] Manor House Offices, Seven Sisters Road, N. [T.A., Lentiscus, London; T.N., 77 Tottenham.] *Chief Eng.*, A. H. Pott; *Traffic Manager*, W. E. Hammond; *Secretary*, A. L. Barker; *Chairman*, E. Garcke; *Directors*, Sir E. Spencer, W. L. Madgen, G. Richardson, C. G. Tegetmeier, J. Devonshire (*Managing Director*).

Mexborough and Swinton Tramways Company, Electricity Works, Rawmarsh, Yorks. [T.N., 266], and 3, Laurence Pountney Hill, Cannon Street, London, E.C. *Manager and Eng.*, P. Priestly; *Cons. Elec. Eng.*, F. E. Stanley; *Traffic Manager*, M. McLeod; *Secretary*, Robert Watson; *Chairman*, L. B. Schlesinger.

Middlesbro, Stockton, and Thornaby Electric Tramway, Bridge Road, Stockton-on-Tees, and Clare Street House, Bristol. [T.A., Tramways, Stockton; T.N., 129.] *Manager*, F. Freshwater; *Per. Way Eng.*, A. W. Barnley; *Secretary*, W. G. Verdon Smith; *Chairman*, Sir Geo. White, Bart.; *Directors*, H. C. Godfray, S. White, H. C. Doggett.

Middleton Electric Traction Company, Hiltonfold Lane, Middleton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depot, Middleton; T.N., 37 Middleton.] *Gen. Manager*, W. F. Endean; *Secretary*, W. S. Woodruffe; *Chairman*, Lord Vaux of Harrowden; *Directors*, J. V. Kitchener, W. S. Wreathall.

Musselburgh and District Electric Light and Tramways Co., Ltd., High Street, Musselburgh, N.B. [T.A., Tramways; T.N., 4.] (Registered Offices, 3, Laurence Pountney Hill, London, E.C. [T.N., 5329 and 5330, Bank.]) *Manager and Elec. Engineer*, C. W. Bentley; *Cons. Eng.*, F. E. Stanley; *Traffic Inspector*, W. Scott; *Secretary*, R. Watson; *Chairman*, L. B. Schlesinger; *Directors*, B. Bernheim, J. Anderson, W. B. Cownie, W. H. Fowler.

New General Traction Company, Ltd., 8, Crosby Square, London, E.C. *Managing Director*, E. A. Hopkins; *Secretary*, J. G. Mills; *Chief Engineer*, I. E. Winslow; *Chairman*, Baron E. B. d'Erlanger.
[This company controls the Coventry, the Norwich, and the Douglas Southern Electric Tramways Companies.]

New St. Helens and District Tramways Company, Ltd., Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36 Atherton.] *Secretary*, H. P. Conibear; *Chairman*, Hon. Arthur Stanley, M.P.; *Directors*, J. Hunter, J.P., H. Martin, J.P., J. M. Henderson, M.P., J. S. Austen, and E. H. Edwardes (*Managing*).

North Shields Tramway Company owned and worked by Tynemouth and District Elec. Trac. Co. *q.v.*

Norwich Electric Tramway Company, 5, Orford Hill, and 8, Crosby Square, London, E.C. [T.A., Tramways, Norwich; T.N., 475.] *Manager and Engineer*, F. W. Ketley; *Traffic Manager*, W. A. Penman; *Consulting Eng.*, I. E. Winslow; *Sec.*, J. G. Mills; *Chairman*, Baron E. B. d'Erlanger; *Directors*, E. A. Hopkins, Hon. A. Brand, F. Fitzgerald, G. M. Chamberlain.

Oldham, Ashton and Hyde Electric Tramway, Ltd., Tramway Depot, Denton, Lancs., and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Denton; T.N., 265 Ashton.] *Supt.*, A. Anderson; *Secretary*, W. E. Woodroofe; *Chairman*, E. Garcke; *Directors*, L. A. Atherley Jones, R. Whittaker, W. S. Wreathall, J. V. Kitchener (*Managing Director.*)

Paisley and District Tramways Company, Tramway Depôt, Paisley, and 83, Cannon Street, London, E.C. [T.N., 218 Paisley.] *Gen. Manager and Elec. Eng.*, Fred Coutts; *Traffic Supt.*, E. Jeffs; *Secretary*, A. Clements; *Con. Eng.*, H. F. Parshall; *Chairman*, O. H. Smith; *Directors*, Lord Arthur Butler, D. Johnston Smith, John Young.

Peterborough Electric Traction Company, Ltd., The Depot, Lincoln Road, Peterborough, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Peterborough.] *Gen. Manager*, G. Chivers; *Secretary*, W. E. Woodroofe; *Chairman*, Lord Vaux of Harrowden; *Director*, E. A. Paris.

Plymouth, Stonehouse and Devonport Tramways Co., 16, Edgcumbe Street, Stonehouse, Devon, and Moorgate Station Chambers, London, E.C. *Manager*, G. H. Moreton; *Elec. Eng.*, J. Graham Pearce; *Cons. Eng.*, J. Glenn; *Sec.*, J. Barber Glenn; *Chairman*, Andrew Beattie, J.P., D.L.; *Directors*, S. Hern, J. B. Glenn (*Managing*), John Glenn.

Poole and District Electric Traction Company, Electrical Federation Offices, Kingsway, London, W.C.
[These Tramways have been sold to Bournemouth Corporation.]

Portsdown and Horndean Light Railway, Cosham, Hants.; Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., Municipal 16 and Nat. 3, Gosport.] *Engineer and Manager*, J. Fereday Glenn; *Cons. Eng.*, John Glenn; *Secretary*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*Managing*), S. Hern, John Glenn.

Potteries Electric Traction Company, Tramway Depôt, Stoke-on-Trent, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Stoke-on-Trent; T.N., 801.] *Gen. Manager and Eng.*, W. Thom; *Power and Rolling Stock Supt.*, F. J. Chapple; *Traffic Manager*, F. Hatch; *Secretary*, W. F. Herring; *Chairman*, G. Cornwallis-West; *Directors*, F. W. Chanter, S. Mear, J. V. Kitchener.

Rhondda Tramways Company, Ltd., Tramway Depot, Porth, Rhondda, and Laurence Pountney Hill, Cannon Street, London, E.C. [T.A., Tramway, Porth; T.N., 8.] *Manager and Engineer*, H. J. Nisbett; *Cons. Eng.*, R. P. Wilson; *Secretary*, L. D. H. Jacobs; *Chairman*, L. B. Schlesinger; *Directors*, J. C. Saunders, W. B. Cownie, J. T. Jervis, F. Barnett.

Rothesay Tramway Company, Ltd., Point House, Rothesay, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, H. T. Bates; *Elec. Eng.*, H. H. Hill; *Sec.*, W. F. Herring; *Chairman*, A. C. Miles; *Directors*, W. L. Madgen, C. S. Hilton.

Ryde Pier Company, Ryde, Isle of Wight. *Manager*, W. D. Stanney; *Elec. Eng.*, C. Harrison; *Chairman*, G. E. Mears.

Searborough Tramways Company, Scalby Road, Scarborough. [T.A., Electric Tramways, Scarborough; T.N., 294.] *Gen. Manager and Elec. Eng.*, W. E. Nicoll; *Chairman*, F. E. Gripper; *Directors*, V. Fowler, M. T. Whittaker, F. Dale, J. C. Wigham.

Sheerness and District Electric Power and Traction Company, Ltd., Electricity Works, Sheerness East, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Sheerness; T.N., 45.] *Manager & Eng.*, C. W. Durnford; *Sec.*, P. N. Gray; *Chairman*, G. J. Somerville; *Directors*, G. Offor, G. Hume.

Snaefell Mountain Railway (See Manx Electric Railway Company).

Soothill Nether Urban District Council and Dewsbury and Ossett Corporation Tramways, (Lessees: The National Elec. Construction Co., Ltd., 3, Laurence Pountney Hill, London, E.C.) [T.A., Overhauled, London; T.N., 5329 and 5330 Bank.] *Manager*, W. MacGibbon.

South Metropolitan Electric Tramways and Lighting Company, Ltd., 114, Church Street, Croydon, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 304 Croydon and 14 Sutton.] *Gen. Manager and Engineer*, A. V. Mason; *Supt.*, A. E. Wray; *Secretary*, S. J. Clements; *Chairman*, C. G. Tegetmeier; *Directors*, J. Devonshire, E. Garcke, G. Offor.

Southport Pier Co., Ltd., Southport. [T.A., Pier, Southport; T.N., 174.] *Manager*, W. H. Scott; *Chairman*, A. Skinner; *Directors*, I. R. Haworth, S. J. Fane, G. Duckworth, J. Duckworth.

Southport Tramway Company, Ltd., The Depôt, Churchtown, Southport, and Electrical Federation Offices, Kingsway, London, W.C. *Manager*, J. Lloyd; *Secretary*, H. Kingsbury; *Chairman*, C. S. Hilton; *Directors*, J. S. Haworth, Lord Vaux of Harrowden, J. V. Kitchener.

South Staffordshire Tramways (Lessee) Company, Ltd., Power Station, Downing Street, Smethwick, Birmingham, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 368 Birmingham, 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, W. S. Schuster, *Directors*, J. A. Lycett (*Managing*), S. R. Blundstone, E. Garcke, W. G. Bond.

Sunderland District Electric Tramways, Ltd., Fence Houses, co. Durham. [T.A., Trams, Shiney Row; T.N., 21, Houghton-le-Spring.] *Resident Manager and Engineer*, G. Stratton; *Traffic Manager*, E. A. Pearman; *Secretary*, H. J. Almond; *Directors*, H. R. Hogg, Hon. R. Parker, R. Tayler.

Sutton and Howth Electric Tramway Company (owned by the Great Northern Railway, Ireland), Sutton, county Dublin, and Amiens Street Terminus, Dublin. [T.A., Railroad, Dublin; T.N., 171, Dublin, and 16 Sutton.] *Gen. Manager*, John Bagwell; *Elec. Eng.*, A. W. Whieldon; *Supt. of Line*, R. J. Moore; *Chief Eng.* F. A. Campion; *Locomotive Supt.*, C. Clifford; *Sec.*, T. Morrison; *Chairman*, F. Vernon; *Directors*, W. P. Cairnes (*Deputy Chairman*), Sir W. Q. Ewart, Bart., W. B. Carson, H. S. Guinness, J. T. Reade, W. L. A. Goulding, Major J. C. W. Madden, R. A. Gradwell, J. Milne Barbour, T. F. Cooke, W. H. B. Moorhead, Lt.-Col. H. Plews.

Swansea Improvements and Tramways Company, 2, Rutland St., Swansea, and Electrical Federation Offices. Kingsway, London, W.C. [T.A., Tramway, Swansea; T.N., 268 Nat., Swansea.] *Gen. Manager*, D. E. James; *Elec. Eng.*, A. Johnston; *Secretary*, S. J. Clements; *Chairman*, C. G. Tegetmeier; *Directors*, G. J. Somerville, S. E. Garcke.

Taunton Electric Traction Company, Ltd., East Reach, Taunton, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Taunton, c/o "Tramways," London.] *Gen. Manager*, B. H. Griffiths; *Managing Engineer*, C. W. Durnford; *Secretary*, S. M. Wright; *Chairman*, G. J. Somerville; *Director*, E. Garcke.

Torquay Tramways Co., Ltd., St. Marychurch Road, Torquay. [T.A., Carsheds, Torquay; T.N., 167 Torquay.] *Registered Office*, 3, Laurence Pountney Hill, Cannon Street, E.C. *Manager and Eng.*, H. Holliday; *Secretary*, L. D. Jacobs; *Managing Director*, W. B. Cownie.

Trafford Park Company (Tramways), Trafford Park, Manchester. [T.A., Developing, Manchester; T.N., 61, Trafford Park.] *Secretary*, C. A. Grundy; *Chairman*, Col. Paget E. Mosley; *Directors*, Sir J. Lyons, Marshall Stevens, Sir W. W. H. Bailey, H. McNiel.
[Lines worked by the Manchester and Salford Corporations.]

Tynemouth and District Electric Traction Company, Limited, John Street, Cullercoats, Northumberland, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tram Co., Cullercoats; T.N., 17 Whitley.] *Gen. Manager*, R. Simpson; *Sec.*, C. W. Francis; *Chairman*, H. S. Day; *Directors*, J. H. Robinson, J. B. Williamson, C. S. B. Hilton, Geo. J. Somerville.

Tyneside Tramways and Tramroad Company, Ltd., Neptune Bank, Wallsend. [T.A., Tramways, Wallsend; T.N., 84.] *Secretary & Res. Manager*, J. C. Little; *Elec. Eng.*, F. H. Briggs; *Cons. Eng.*, W. McLellan; *Chairman*, J. T. Merz; *Directors*, Lord Armstrong, J. H. Armstrong, G. E. Henderson, S. Hunter.

Wakefield and District Light Railway Company, Belle Isle, Wakefield.
[This company has been amalgamated with the Yorkshire (West Riding) Electric Tramways Co., Ltd.]

Walton-on-the-Naze Pier Tramway (Coast Development Corporation, Ltd.), The Pier, Walton-on-the-Naze. [T.A., Electricity Works, Walton-on-Naze.] *Elec. Eng.*, E. A. Lambert; *Sec.*, J. F. Stovell; *Chairman*, Sir T. Sturmey Cave; *Directors*, H. R. Spence (*Managing*), G. Riley, C. F. Pritchard, P. Denny, — Mitchell.

Wemyss and District Tramways Company, Ltd., Car Depot, Aberhill, Methill, N.B. [T.A., Tramways, Methill; T.N., 38 Leven.] *Gen. Manager*, W. T. Dawson; *Traffic Manager*, W. T. Mittell; *Chief Eng.*, R. Richardson; *Cons. Eng.*, Stephen Sellon; *Sec.*, J. O. Shepherd; *Chairman*, ; *Directors*, J. Oswald, A. Bowman, W. Shepherd, Capt. V. L. Gordon, G. Balfour.

Weston-super-Mare Tramway Company, Locking Road, Weston-Super-Mare, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Weston-s.-Mare; T.N., 79 & 181.] *Manager and Elec. Eng.*, G. Charlton; *Sec.*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, S. G. Offor, E. Garcke.

Wolverhampton District Electric Tramways, Limited, Power Station, Downing Street, Smethwick, Birmingham, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 368 Central Birmingham, 65 Smethwick.] *General Manager*, W. G. Bond; *Sec.*, B. Kingsford; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, W. G. Bond.

Worcester Electric Traction Company, Ltd., St. John's, Worcester, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Worcester; T.N., 81.] *Traffic and General Manager*, J. R. Groves; *Elec. Eng.*, H. J. Smith; *Secretary*, H. J. Cox; *Chairman*, H. S. Day; *Directors*, J. A. Lycett, S. B. Hilton, S. E. Garcke.

Wrexham and District Electric Tramways Limited, Tramway Depot, Johnstown, Ruabon, N. Wales, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Rhosllanerchrugog; T.N., 9 Rhos, Ruabon.] *Gen. Manager*, A. A. Hawkins; *Sec.*, W. E. Bennett; *Chairman*, J. V. Kitchener; *Directors*, G. J. Somerville, W. L Madgen, W. S. Wreathall.

Yorkshire (West Riding) Electric Tramways Co., Ltd., Belle Isle, Wakefield. [T.A., England, Belle Isle, Wakefield; T.N., 213.] *Gen. Manager and Sec.*, H. England; *Elec. Engs.*, C. J. Jewell and E. A. Wood; *Traffic Supt.*, W. Wilde; *Cons. Elec. Eng.*, V. B. D. Cooper; *Chairman*, Sir Herbert S. Leon, Bart.; *Directors*, E. Schenk, B. Newgass, G. E. Leon.

Yorkshire (Woollen District) Electric Tramways, Limited, Frost Hill, Liversedge, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Heckmondwike; T.N., 8 Heckmondwike.] *Traffic Manager*, E. Parkinson; *Secretary*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Sir Thos. Pilkington, E. A. Paris (*managing*).

TRAMWAY ASSOCIATIONS.

MUNICIPAL TRAMWAYS ASSOCIATION.

President:
A. R. Fearnley
(general manager, Sheffield Corporation Tramways).

Vice-President:
Alderman H. Linsley
(Mayor of Salford).

Hon. Secretary and Treasurer:
C. J. Spencer
(general manager, Bradford Corporation Tramways), 7, Hall Ings, Bradford.

TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

President:
The Rt. Hon. Viscount Chilston.

Chairman:
The Hon. Arthur Stanley, M.P.

Vice-Chairman:
Harry England.

Hon. Solicitor: W. Morris, Junr.
Hon. Auditor: A. W. Chambers, A.S.A.A.

Secretary:
A. de Turckheim.

Offices: Caxton House, Westminster, London, S.W.
Telephone No. 2110 Victoria.

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LIST OF ELECTRIC TRAMWAYS & RAILWAYS.

PARTICULARS OF TRACK AND EQUIPMENT.

TRAMWAYS, pp. xxxi-xxxiv. RAILWAYS, p. xxxiv.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.		Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No of Motor Cars.	No of Dynamos	How Driven.	No. of Engines	Type of Engines	Total Capacity Traction, kw.	Contractors for Electrical Apparatus.
TRAMWAYS.				ft.	in.	lbs.	1 in	ft. rad.							
Aberdeen Corporation	Dec., 1899	14·4	27·75	4	8½	96 G	13	42·5	71	*14	D-C.	14	V. Cp. C.	4,610	Macartney, McElroy & Co.
Aberdeen Suburban Trys. Co. ..	June, 1905	5	5	4	8½	95 G	28	90	9	..	..	..	..	..	J. G. White & Co. Brush Co.
Accrington Corporation	Aug., 1907	7	10·66	4	0	95 G	14	..	27	*8	..	8	..	1,888	Brush Co.
Airdrie & Coatbridge Tramway Co.	Feb., 1904	3·63	4·94	4	8½	94 G	14	210	15	..	..	..	..	..	Brush Co.
Ashton-under-Lyne Corporation ..	Aug., 1902	7	8·15	4	8½	96 G	10	40	21	5	..	5	..	400	Dick, Kerr, & Co. Siemens Bros.
Aston Manor Corporation	June, 1904	6·5	11	3	6	102 G	15	36¾	48	2	D-C.	2	..	1,000	Brush Elec. Co.
Ayr Corporation	Sept., 1901	6	7·612	4	8½	90 G	21	45	20	*8	D-C.	8	..	400	British T-H.
Barking Town Urban District ..	Dec., 1903	2·6	3·125	4	8½	100 G	25	44	9	4	D-C.	3	V. Cp. C.	..	Blackwell & Co.
Barnsley & Dist. Elec. Traction Co.	Nov., 1902	3·06	4·25	4	8½	97 G	10	60	13	*6	D-C.	6	..	..	J. G. White & Co. Brush Co.
Barrow-in-Furness	Feb., 1904	5·37	8·25	4	0	90 G	13	50	16	*8	..	..	..	..	Brush Co. Dick, Kerr, & Co.
Bath Electric Tramways, Ltd.	Jan., 1904	14·7	19·3	4	8½	95 G	10·7	38	40	4	D-C.	4	H.T. Cp.	675	Westinghouse
Batley Corporation	Oct., 1903	6·536	10·47	4	8½	104 G	9	40	15	4	D-C.	4	..	..	B. I. W. Co. British Elc. Cr. Co.
Belfast City	Dec., 1905	38·5	81·25	4	8½	105 G	15	35	250	3	D-C.	3	Tri. Exp.	3,000	J. G. White & Co. Westinghouse
Bessbrook—Newry (1) .. .. Bessbrook and Newry Try. Co.	Oct., 1885	3	3	3	0	41 V	80	55	2	2	..	1	Hyd. Turb	..	Mather & Platt
Bexley Urban District	Oct., 1903	5·25	6·42	4	8½	90 G	14	40	16	2	..	2	V. Cp.	..	Dick, Kerr, & Co.
Birkenhead Corporation	Feb., 1901	13·8	24·09	4	8½	100 G	13½	40	59	6	D-C.	6	V. Cp.	..	Blackwell & Co British T-H.
Birmingham Corporation	Jan., 1904	34·11	101·5	3	6	105 G	13	40	360	..	..	..	..	1,475	Dick, Kerr, & Co.
Birmingham Trys. Co., City of ..	May, 1901	18·25	28·46	3	6	97 G	16	40	100	8	D-C.	7	H.C.Cp.	..	British T-H.
Birmingham and Midland Trys. Co.	July, 1904	12·20	18·8	3	6	85 & 94 G	15	31	62	6	D-C.	6	Cp.	..	Brush Co.
Blackburn Corporation	March, 1899	14·67	24·63	4	0	92 G	15	30	61	*4	D-C.	4	V. Cp. C.	..	British T-H. Blackwell & Co.
Blackpool Corporation	Oct., 1885	14·75	21·31	4	8½	96 G	20	36	72	..	..	..	Stm. Turb.	600	Elwell-Parker British T-H.
Blackpool & Fleetwood Tramrd. Co.	July, 1898	7·9	15	4	8½	56 & 70 V 98 G	26	80	37	5	D-C.	5	V. Cp.	600	Mather & Platt Dick, Kerr, & Co.
Blackpool and Fylde Light Ry. Co.	Under cons.	14	14·5	4	8½	..	..	..	..	..	..	..	..	..	
Blackpool—St. Anne's & Lytham ..	May, 1903	7·47	14·03	4	8½	92 G	22	35	40	..	..	..	..	..	British T-H.
Bolton Corporation	Nov., 1899	26	47·17	4	8½	90 G	14	35	106	*12	D-C.	12	V. Cp. C.	3,800	Dick, Kerr, & Co. Blackwell & Co.
Bootle Corporation	May, 1900	4·125	7·75	4	8½	95 G	20	40	55	8	D-C.	8	..	..	Blackwell & Co.
Bournemouth Corporation	July, 1902	22	29·62	3	6	100 G 66 slot	10	40	81	4	D-C.	4	Cp.	1,500	J. G. White & Co.
Bradford Corporation	July, 1898	54·8	101·85	4	0	102 G	9·8	40	239	11	D-C.	11	V. Cp. C.	..	Westinghouse Blackwell & Co.
Bray and Enniskerry Railway Co.	Under cons.	3·25	5	3	6	..	..	..	..	..	..	..	..	..	
Brighton Corporation	Nov., 1901	9·48	17·15	3	6	101 G	9	40	50	5	..	5	Stm. Turb.	1,000	Macartney & Co. Westinghouse Blackwell & Co.
Brighton Beach (1)	Aug., 1883	1·75	2	2	8½	35 V	100	80	8	2	B	1	Gas	..	Siemens Bros.
Bristol—Bristol Trys. Co.	Oct., 1895	31	57·5	4	8½	92½ G	10	30	232	6	D-C.	4	V. Cp. C.	..	British T-H. and Blackwell & Co.
Burnley Corporation	Dec., 1901	11·9	21·5	4	0	102 & 107 G	9·8	35	57	*8	D-C.	8	H. Cp. C.	750	British T-H.
Burton and Ashby Light Railway..	July, 1906	10·2	12·3	3	6	90 G	11	51	20	2	D-C.	2	Diesel	330	Dick, Kerr & Co. Brush Co.
Burton-on-Trent Corporation ..	Aug., 1903	6·67	9·75	3	6	90 G	11·7	40	20	4	D.C.	3	V. Cp.	400	Dick, Kerr, & Co. Blackwell & Co.
Bury Corporation	June, 1903	22·5	34·5	4	8½	102¾ G	12	40	50	6	..	6	..	1,500	Westinghouse
Camborne and Redruth	Nov., 1902	3·75	4	3	6	83 G	15	40	8	7	D.C.	7	Cp.	1,525	Dick, Kerr, & Co. British T-H.
Cardiff Corporation	May, 1902	17·25	31·75	4	8½	100 G	23	35	130	9	D-C.	9	V. Cp. C.	2,200	British T-H. Dick, Kerr, & Co.
Carlisle, City of, Elec. Try. Co. ..	June, 1900	7·25	8·5	3	6	83 G	14	23	15	4	D-C.	4	..	..	Dick, Kerr, & Co.
Cavehill & Whitewell Try. Co...	Feb., 1906	3·29	4·31	4	9	105 G	31	75	10	..	..	..	..	..	J. G. White & Co.
Chatham & District Light Rly. Co.	June, 1902	14·98	26	3	6	92½ & 105 G	9	35	47	5	D-C.	4	H. Cp.	675	British T-H. Co. Brush Co.
Cheltenham and District ..	Aug., 1901	10·22	12·25	3	6	80 & 90 G	8·9	37	20	2	D-C.	2	V. Cp.	..	Westinghouse
Chester Corporation..	April, 1903	3·51	6·3	3	6	94 & 100 G	30	40	18	*7	D-C.	7	V. Cp. C.	240	Blackwell & Co. British T-H.
Chesterfield Corporation	Dec., 1904	3·6	5·1	4	8½	96 & 101 G	20	40	14	4	D-C.	4	V. Cp. C.	800	Milnes & Co. Westinghouse Brush
Clontarf and Hill of Howth ..	July, 1900	5·5	6·5	5	3	90 & 60 G	13	34	12	..	..	..	..	..	W. M. Murphy & Co.
Colchester Corporation	July, 1904	6	7·75	3	6	95 G	12	43	18	8	..	8	V. Cp.	1,140	Dick, Kerr & Co. J. G. White & Co.
Colne and Trawden Light Railway	Nov., 1903	5·2	6·7	4	0	102 G	13	60	12	*	..	..	..	..	Blackwell & Co. Glover & Co.
Cork Elec. Try. & Lighting Co. ..	Dec., 1898	10	15	2	11½	83 G	14	26	35	*9	D-C.	9	H. Cp. C.	1,450	British T-H. Blackwell & Co.
Coventry Corporation Tramways..	Dec., 1895	13·25	15·75	3	6	65 G 81 G	16	35	40	5	D-C.	5	H. & V. Cp.	700	Westinghouse Blackwell & Co.
Croydon Corporation	Sept., 1901	11	18·10	4	8½	96·5 G	16	40	75	*13	D-C.	13	..	2,000	British T-H. Co.
Darlington Corporation	June, 1904	4·875	8·88	3	6	90 G	14	46	16	9	..	7	..	..	Westinghouse

* Current from combined lighting and traction station. (1) Third rail system.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.		Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars	No. of Dynamos	How Driven.	No. of Engines	Type of Engines.	Total Capacity Traction, kw.	Contractors for Electrical Apparatus.
TRAMWAYS—*continued.*				ft.	in.	lbs.	1 in	ft. rad.							
Dartford U. D. C.	Feb., 1906	6·5	8·5	4	8½	100 G	12	35	12	4	..	..	..	..	British I. W.
Darwen Corporation	Oct., 1900	4·36	7·13	4	0	95 G	9	35	17	*4	D-C.	4	H. Cp.	..	British T-H.
Derby and Ashbourne	..	14·5	..	4	8½										
Derby Corporation	July, 1904	13	22·06	4	0	95 G	14	46	50	3	..	3	Stm.Turb.	..	J. G. White & Co. Brush Co.
Devonport & District Try. Co., Ltd.	June, 1901	8·85	15·79	3	6	92 G	11	35	25	*	..	..	..	..	Blackwell & Co
Devonport Corporation	June, 1901	..	7	3	6	97 G	10	50	12	..	..	..	..	..	Blackwell & Co.
Doncaster Corporation	June, 1902	8·25	11·77	4	8½	94 G	16	45	25	8	D-C.	8	..	1,000	Blackwell & Co.
Dover Corporation	Sept., 1897	4·75	7	3	6	87 & 90 G	10	44	21	*2	D-C.	2	H.CC.	..	Dick, Kerr, & Co.
Douglas—Port Soderick .. .. Douglas Southern Elec. Trys. Co.	Aug., 1896	3·25	3·75	4	8½	65 V	12	45	8	2	B	2	H. Cp.	200	Westinghouse British T-H.
Dublin & Lucan Elec. Railway Co.	March, 1900	6·5	7	3	6	50 V	20	27	16	2	D-C.	2	H. Cp.C.	240	Dick, Kerr, & Co.
Dublin United Tramways Co. ..	May, 1896	49·8	95·26	5	3	105 G	12·3	22	365	8	D-C.	7	V. Cp. C.	4,300	Dick, Kerr, & Co. Blackwell & Co. British T-H.
Dudley and Stourbridge Trys. British Electric Traction Co.	July, 1899	21·25	27·25	3	6	90 G	11	50	59	4	D-C.	4	H. Cp.	..	British T-H. Blackwell & Co.
Dumbarton	Feb., 1907	13	17	4	7¾	90 & 96	14	60	26	3	D-C.	3	..	..	Dick, Kerr, & Co.
Dundalk	Under cons.	6	6·25	3	6	97 G	10	50	12						J. G. White & Co.
Dundee, Broughty Ferry, and District	Dec., 1905	5	9·125	4	8½	90 G	16·5	30½	14	3	D-C.	3	V. Cp. C.	..	J. G. White & Co British T-H. Co.
Dundee Corporation	July, 1900	15·5	27·47	4	8½	90 & 100 G	10	35	66	5	D-C.	5	..	..	Blackwell & Co.
Dunfermline (Fife Try. & Power Co.)	Nov., 1909	13·3	16	..		90 G	10	25	28	2	D-C.	2	..	..	
East Ham Corporation	June, 1901	7·26	14·32	4	8½	90 & 105 G	25	40	45	5	D-C.	5	H. Cp.	500	Dick, Kerr, & Co.
Eccles Corporation	May, 1902	5	7·75	4	8½	100 G	..	..	..	..	..	..	..	..	
Edinburgh and District	June, 1910	1·25	1·5	4	8½	100 G	21	54	4	..	..	..	..	..	Dick, Kerr, & Co.
Erith Urban District Council ..	Aug., 1905	4·7	8·4	4	8½	100 G	17	40	17	3	..	5	..	..	Brush Co. WestinghouseCo.
Exeter Corporation	April, 1905	4·875	7	3	6	90 G	11·5	35	20	*4	D-C.	4	H. Cp.	..	Dick, Kerr, & Co.
Falkirk and District	Oct. 1905	7·81	10·5	4	0	90 G.	11·3	48	18	*	..	..	..	..	Bruce Peebles & Co.
Farnworth Urban District.. ..	Jan., 1902	4·33	7·16	4	8½	98 G	29	36	13	4	D-C.	4	..	..	
Felixstowe Pier	Aug., 1905	0·5	0·5	3	6	36	..	..	3	..	..	..	..	..	
Gateshead and District	May, 1901	11·25	17·30	4	8½	90 G	8	35	53	*	..	..	..	..	Dick, Kerr, & Co. Blackwell & Co.
Giant's Causeway Elec. Try. Co. ..	Sept., 1883	8	9	3	0	42 V 75 G	24	30	26	2	B	2	Hyd. Turb.	..	Siemens Bros. British T-H.
Glasgow Corporation	Oct., 1898	98·18	196·25	4	7¾	110 G	11·93	30¾	808	7	D-C.	7	V. Cp.	14,200	British T-H. Westinghouse
Glossop Urban District	Aug., 1903	4·56	5·6	4	8½	90 G	13	40	8	4	D.C.	4	V. Cp.	200	British T-H.
Gloucester Corporation Light Rly.	May, 1904	9	15·02	3	6	90 G	25	40	30	*2	..	2	Cp.	750	Brush Co. Dick, Kerr, & Co.
Gosport & Fareham Trys. Co. ..	Jan., 1906	7·5	11·5	4	7¾	96 G	16	37½	22	3	D-C&A-C	3	V. Cp. C.	750	Dick, Kerr, & Co. Brush Co.
Gravesend and Northfleet ..	Aug., 1902	6·5	9	4	8½	87 G	11	45	18	*					
Great Crosby	June, 1900	2·5	2·5	4	8½	92½ G	..	40	14	*7	..	7	H. & V. Cp.	160	Dick, Kerr, & Co. Blackwell & Co.
Great Grimsby	Dec., 1901	6	11	4	8½	90 G	15	26	38	2	D-C.	2	..	300	Dick, Kerr, & Co.
Greenock and Port Glasgow ..	Oct., 1901	7·425	14·05	4	7¾	90 G	11	60	42	*					
Guernsey Railway Co.	Nov., 1892	3	3	3	8½	40 & 74 V 84 G	60	60	18	2	B	2	H. & V. Cp.	160	Siemens Bros. British T-H.
Halifax Corporation	June, 1898	37·4	54·2	3	6	95½ G	9·5	38·6	95	*9	D-C.	9	H. & V. Cp.	2,500	Electric Cons. Co. British T-H.
Hampshire Light Railway (Elec.) Co.	March, 1903	6	9	4	8½	..		..	10	*					
Hartlepool Electric Tramways Co.	May, 1896	6·72	8·3	3	6	87 & 90 G	15	35	21	4	D-C.	4	V. Cp.	..	Electric Cons. Co. Dick, Kerr, & Co.
Haslingden Corporation	July, 1908	3	3	4	0	100 G	10	30	..	..	..	..	..	..	Dick, Kerr, & Co.
Hastings and District (2)	July, 1905	19·33	34	3	6	90 G	8	36·75	65	6	D-C.	6	V. Cp.	2,100	Dick, Kerr, & Co.
Herne Bay Pier (1)	March, 1899	·75	·75	3	0	60	..	..	3	1	B	1	Gas	50	British T-H.
Heywood Corporation	Dec., 1905	4·25	4·25	4	8½	90 G	17	..	..	3	..	3	..	..	Blackwell & Co. B.I. & H.C. Co.
Houghton-le-Spring (See Sunderland Dist. Elec. Trys.)															
Huddersfield Corporation	Feb., 1901	28·41	46	4	7¾	98 G	11	35	86	4	D-C.	4	V. Cp. C.	2,200	British T-H.
Hull Corporation	July, 1899	13·46	29·43	4	8½	94 G	20	30	151	7	D-C.	7	V. Cp. C.	2,560	British T-H. Westinghouse
Ilford Urban District	Mar., 1903	6·5	11·28	4	8½	95 G	13	33·3	26	*7	D-C.	7	..	1,600	British T-H. Dick, Kerr, & Co.
Ilkeston Corporation	May, 1903	3·8	4·3	3	6	90 G	12	28	13	2	D-C.	1	..	..	Dick, Kerr, & Co.
Ipswich Corporation	Nov., 1903	10·8	14·87	3	6	90 G	11·5	40	36	10	D-C.	10	Enclos'd	1,175	Westinghouse
Isle of Man—															
Manx Elc. Rly. Co. Douglas to Ramsey ..	July, 1893	18	35·75	3	0	62½ V	24	90	65	9	D-C.	9	H. Cp.	1 300	Mather & Platt
Manx Elc. Rly. Co. Snaefell Mountain ..	Aug., 1895	4·5	9·5	3	6	56 V	12	90							
Isle of Thanet Trys. & Ltg. Co. ..	April, 1901	11	20·67	3	6	90 G	11	38	59	*6	D-C.	6	3 V. Cp. 3 H. Cp.	800	British T-H. Blackwell & Co.
Jarrow and District	Nov., 1906	2·54	3·42	4	8½	95 G	12·5	50	10	..	..	..	..	..	Brush Co. B.I. & H.C. Co.
Kearsley Urban District	Jan., 1902	1·75	1·75	4	8½	95 G	20	..	..	..	..	..	..	..	Westinghouse
Keighley Corporation	Oct., 1904	3·5	6·11	4	0	95 G	25	60	12	*4	D-C.	4	V.	200	Blackwell & Co. Brush Co.
Kidderminster—Stourport British Electric Traction Co.	May, 1898	4·6	4·87	3	6	75 G	14	45	13	*5	..	5	Stm Turb.	..	Brush Elc. Eg. Co.
Kilmarnock Corporation	Dec., 1904	4·18	5·5	4	8½	90 G	24	45	14	*3	D-C.	3	..	250	Blackwell & Co.
King's Norton & Northfield U. D.	May, 1904	5·25	8·25	3	6	105 G	15&21	100&145	..	..	..	..	..	..	Blackwell & Co.
Kinver	April, 1901	4	4	3	6	63 & 90 G	..	..	6						
Kirkcaldy Corporation	Feb., 1903	6·11	8·65	3	6	100 G	11	40	22	*8	D-C.	6	Cp. H.S.	1,090	British T-H. Co.
Lanarkshire Tramway Co... ..	July, 1903	21·21	34·4	4	7¾	96 & 101 G	9·4	37	60	4	D-C.	4	3 H. Cp. 1 V. Cp.	825	British T-H. Co.
Lancashire United Tramways Co.	Oct., 1902	39	54	4	8½	90 G	15	50	82	*5	D-C&A-C	5	V. Cp. C.	2,750	B. I. W. Co.
Lancaster Corporation	Jan., 1903	4	4·81	4	8½	90 G	8	30	12	4	D-C.	4	V. Cp.	200	Greenwood & Batley, Ltd.
Leamington & Warwick Elec. T. Co.	July, 1905	3·04	6·1	3	6	65 G	12	47	12	3	..	3	Cp.	..	Brush Co.
Leeds City	Aug., 1897	57·43	112·77	4	8½	105 & 111 G	8·4	32	296	5 3	D-C. ..	5 3	H. Cp. C. Stm. Tur	6,150	Elec. Con. Co. Greenwood & Batley, British T-H. Blackwell & Co.

* Current from combined lighting and traction station. (1) Third Rail system. (2) Trolley and short section of Dolter surface contact system.

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ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total length of Track.	Gauge.		Weight and Type of Rail.	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	How Driven.	No. of Engines	Type of Engines.	Total Capacity Traction, kw.	Contractors for Electrical Apparatus.
TRAMWAYS—*continued.*				ft.	in.	lbs.	1 in	ft. rad.							
LEICESTER Corporation	May, 1904	20	37	4	8½	100 G	16	35	140	4	D-C.	4	V. Cp.C.	2,500	Dick, Kerr, & Co. Blackwell & Co.
LEITH Corporation	Aug., 1905	9·08	17·9	4	8½	106·7 G	19	54	37	*11	D-C.	11	..	1,600	Brush Co.
LEYTON URBAN DISTRICT	Dec., 1906	9·125	18·5	4	8½	105 & 111 G	24	45	60	*8	..	8	Cp.	1,600	..
LINCOLN Corporation (1)	Nov., 1905	1·75	2·96	4	8½	100 G	..	..	8	*8	..	8	..	645	Blackwell & Co.
LIVERPOOL Corporation	Nov., 1898	63	116	4	8½	95 & 98 G	13	40	573	*55	D-C.	55	V. Cp. Trip Exp	35,300	British T-H. Dick, Kerr, & Co. Westinghouse
LIVERPOOL Overh'd Ry. (Trol. Ln. Ex.)	June, 1900	2·5	2·5	4	8½	92½ G	Nil	40	14	7	D-C.	7	H. & V. Cp.	160	Dick, Kerr, & Co.
LLANDUDNO AND COLWYN BAY ..	Oct., 1907	6·60	7·573	3	6	90 G	11·5	45	18	*	..	..	..	..	Bruce Peebles & Co.
LLANELLY and District	July, 1911	6·25	6·75	4	8½	90 G	..	..	10	*2	D-C.	2	Trip. Ex.	..	
LONDON County Council (2) ..	May, 1903	135·68	273	4	8½	105 G	11	45	1584	8	D-C.	8	V. Cp. C.	34,000	Dick, Kerr, & Co. Westinghouse
LONDON United Tramways Co. ..	April, 1901	55·25	102·45	4	8½	92½ & 100 G	18	28	339	7	D-C.	5	V. Cp.	3,500	British T-H. Westinghouse. Blackwell & Co.
LOWESTOFT Corporation	July, 1903	4·75	5·5	3	6	100 G	27	36	19	*5	D-C.	5	Cp.	..	Blackwell & Co.
LUTON Corporation Tramways (Leased to J. G. White & Co., Ltd.) ..	Feb., 1908	5·25	6·25	4	8½	95 G	11	35	12	*1	D-C.	1	..	..	J. G. White & Co.
MAIDSTONE Corporation	July, 1904	5·5	7·3	3	6½	96 G	9	35	19	6	D-C.	6	..	300	Dick, Kerr & Co.
MANCHESTER Corporation	June, 1901	112·76	184·97	4	8½	105 G	14·9	35	617	*22	D-C.	22	Turb'nes	45,300	British T-H. Dick, Kerr, & Co.
MANSFIELD and DISTRICT Co. ..	July, 1905	10	12·25	4	8½	90 G	17	50	20	*3	..	3	..	..	
MERTHYR	April, 1901	2·98	3·94	3	6	96 G	11	66	16	*4	D-C.	4	H.S.V.	..	Dick, Kerr, & Co.
METROPOLITAN Electric Trys., Ltd.	July, 1904	52·5	105	4	8½	100 G	12	40	312	5	..	5	1 Stm. Tur	..	British T-H. Brush Co.
MEXBOROUGH & SWINTON Trys. Co.	Feb., 1907	7·75	10·75	4	8½	90 G	8·5	55	20	3	..	3	..	1,300	Brush Co.
MIDDLESBRO', STOCKTON, & THORNABY Electric Tramways Co.	July, 1898	10·5	15·825	3	6	92½ G	17	35	60	3	D-C.	4	H. & V. Cp.	900	British T-H. Blackwell & Co.
MIDDLESEX County Council.. ..	Aug., 1904	25·5	51	4	8½	..	..	..	..	..	..	..	..	..	
MIDDLETON Corporation	March, 1902	2·5	5	4	8½	..	..	..	..	..	..	..	..	..	
MIDDLETON Electric Traction Co. ..	March, 1902	8·5	10·53	4	8½	90 G	15	49½	28	3	D-C.	3	..	500	Glover & Co.
MUSSELBURGH and District ..	Dec., 1904	6·5	8·125	4	8½	90 G	34	45	16	4	D-C.	3	..	400	B. T-H. Co., Nat. Elec. Cons. Co.
NELSON Corporation	Feb., 1903	2·74	3·86	4	0	106 G	11	41	9	*4	D-C.	4	..	400	Blackwell & Co. British T-H. Co. Brush Co.
NEW ST. HELENS & DISTRICT Trys. Co.	July, 1899	18	20	4	8½	95 G	13	35	36	*4	D-C.	4	V. Cp. C.	..	Westinghouse British T-H.
NEWCASTLE Corporation	Dec., 1901	31·25	60·25	4	8½	101 G	11	35	186	5	D-C.	5	V. Cp.	..	Westinghouse British T-H.
NEWPORT (MON.) Corporation ..	April, 1903	7·5	14·5	4	8½	98 G	10·5	40	44	5	..	5	V. Cp.	1,750	Westinghouse
NORTHAMPTON Corporation	July, 1904	5·5	9·25	3	6	90 & 96 G	18	50	26	3	..	3	V.C.C.	520	Dick, Kerr, & Co. Brush Co.
NORTH SHIELDS Tramways Co. ..	March, 1901	..	7·75	3	6	90 G	10	36	22						
NORTH STAFF. Trys. (*vide* Potteries)															
NORWICH Electric Tramways Co. ..	July, 1900	14·5	19·25	3	6	65½ & 90 G	12·6	38	52	4	D-C.	4	H. T. Cp.	800	Westinghouse Blackwell & Co.
NOTTINGHAM Corporation	Jan., 1901	19·75	36·5	4	8½	107 G	11·5	40	135	3	..	3	..	..	British T-H. Dick, Kerr, & Co.
OLDHAM, ASHTON & HYDE Trys. Co.	June, 1899	8·888	11·183	4	8½	97 G	11	28	46	*3	D-C.	3	V. Cp. C.	..	British T-H. Blackwell & Co.
OLDHAM Corporation	Dec., 1900	23·42	36·175	4	8½	100 & 102 G	10·5	40	92	*4	D-C.	4	..	2,220	Dick, Kerr, & Co.
PAISLEY & DISTRICT Tramways Co.	June, 1904	15	25	4	7¾	90 G	10	34	58	..	..	..	..	..	
PERTH Corporation	Oct., 1905	4·846	6·5	3	6	90 G	16	25	12	5	D-C.	5	Cp.	500	Blackwell & Co.
PETERBOROUGH Elec. Traction Co...	Jan., 1903	5·33	6·71	3	6	94 G	31	35	14	..	..	..	..	..	Blackwell & Co. Dick, Kerr, & Co.
PLYMOUTH Corporation	Sept., 1899	7·75	15	3	6	92 G	9	35	42	3	D-C.	3	V. Cp.	..	Elec. Cons. Co. Westinghouse Blackwell & Co.
PLYMOUTH, STONEHOUSE, and DEVONPORT	Nov., 1901	1·5	3·62	3	6	84 G	11	34	14	..	..	..	..	..	Blackwell & Co. Dick, Kerr, & Co.
PONTYPRIDD URBAN DISTRICT ..	March, 1905	5·5	8·6	3	6	96 & 100 G	10	27·6	26	4	D-C.	4	V.C. Cp.	450	B. I. W. Co. Blackwell & Co.
PORTMADOC & SOUTH SNOWDON Rly.	Under cons.	13·25	15	1	11½	41	28	200	6	..	..	..	..	..	
PORTSDOWN & HORNDEAN Tramway	March, 1903	6	7·5	4	7¾	96 G	16	40	16	2	D.C.	2	Oil	200	Dick, Kerr, & Co. Brush Co.
PORTSMOUTH Corporation	Sept., 1901	15·75	30·83	4	7¾	96 & 100 G	17	35	100	5	D-C.	4	V. & H. Cp.	2,075	Macartney & Co. Dick, Kerr, & Co.
POTTERIES Electric Traction Co. ..	May, 1899	31·67	41·48	4	0	87, 90, 100, & 110 G	11	45	110	8	D-C.	8	H.Cp. V.Cp.	2,275	Dick, Kerr, & Co. Blackwell & Co.
PRESTON Corporation..	June, 1904	10·54	17·2	4	8½	95 G	16	28	30	2	D-C.	2	H. Cp.	600	Dick, Kerr, & Co.
RADCLIFFE URBAN DISTRICT ..	April, 1905	5	6·5	4	8½	100 G	15	40	..	3	..	2	V. Cp.	..	Mather & Platt
RAWTENSTALL Corporation	May, 1909	12	15·71	4	0	100 G	15	38	22	*3	D.C.	3	..	850	Westinghouse
READING Corporation	July, 1903	7·44	13·175	4	0	96 G	16	35	36	4	D.C.	4	V. Cp.	400	Blackwell & Co. Dick, Kerr, & Co. Westinghouse
RHONDDA Tramways Co.	July, 1908	17·5	24·5	3	6	95 G	15	45	50	8	..	4	..	1,400	British T-H. Brush
ROCHDALE Corporation	May, 1902	19·58	28·2	4	8½	103½ G	11·7	30	69	..	..	..	..	..	British T-H. Dick, Kerr, & Co. Brush Co.
ROTHERHAM Corporation	Jan., 1903	10	12	4	8½	100 G	9·5	45	36	*6	D-C.	6	H.S. Cp.	1,485	Dick, Kerr, & Co.
ROTHESAY	June, 1902	4·81	9·68	3	6	94 G 77 G	24	34	20	3	D-C.	3	V. & Oil	350	Dick, Kerr, & Co. Westinghouse
RYDE PIER, ISLE OF WIGHT Ryde Pier Co. (3) ..	March, 1886	·5	1	4	8½	30 & 34 V	..	..	4	2	B	2	Gas	..	Siemens Bros.
SALFORD Corporation	Oct., 1901	41·25	75	4	8½	103 G	20	47	200	*8	D-C.	9	V. Cp. C.	2,400	Westinghouse Mather & Platt
SCARBOROUGH Tramways Co. ..	May 1904	5	7·75	3	6	90 G	10·5	35	22	2	..	2	Stm. Turb.	..	Brush Elec. Co.
SHEERNESS and District	April, 1903	2·5	2·704	3	6	94 G	43	40	8	6	D-C.	5	V. Cp. C.	100	Siemens & Halske Brush Co.
SHEFFIELD Corporation	Sept., 1899	40	76·72	4	8½	110 & 116 G	9·5	35	269	7	D-C.	7	1 H.Cp. 6 V.Cp.	5,725	British T-H.

* Current from combined lighting and traction station. (1) G.B. surface contact system. (2) Mainly Conduit system, but there are now several Trolley lines. Besides the electric lines the London County Council has also 8·54 route miles of horse tramways. (3) Third rail system.

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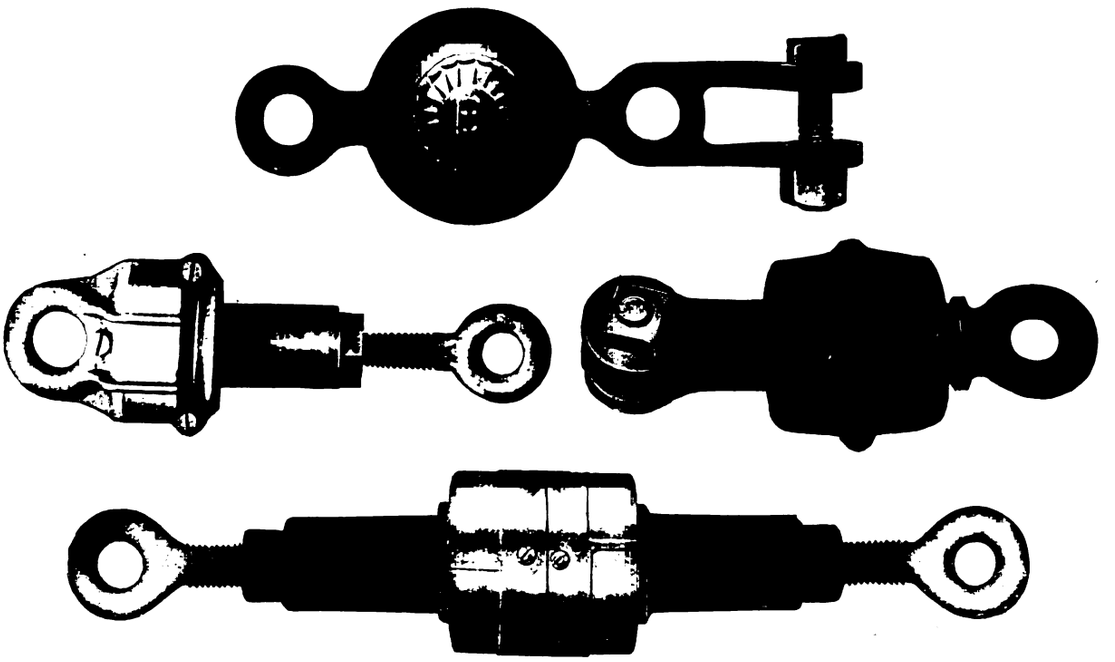
ELECTRIC TRAMWAYS & RAILWAYS.—Particulars of Track and Equipment.

Location of Line and Name of Operating Company.	Date of Opening of First Section.	Length of Route.	Total Length of Track.	Gauge.	Weight and Type of Rail	Maximum Gradient.	Sharpest Curve.	No. of Motor Cars.	No. of Dynamos	How Driven.	No. of Engines	Type of Engines.	Total Capacity Traction, KW.	Contractors for Electrical Apparatus
TRAMWAYS—*continued.*				ft. in.	lbs.	1 in	ft. rad.							
SHIPLEY URBAN DISTRICT	May, 1902	6	10	4 0	98 G	15	..	..	4	..	3	..	..	British T-H.
SOUTHILL NETHER U.D.C. & DEWSBURY & OSSETT CORPORATIONS ..	Nov., 1908	3·125	4·45	4 8½	90 G	13	50	8	*	..	..	..	..	Nat. Elec. Cons. Co.
SOUTHAMPTON Corporation	Jan., 1899	10·25	17·75	4 8½	96 G	13	45	68	6	D-C.	6	H. Cp. C.	1,000	Westinghouse
SOUTHEND Corporation	July, 1901	7·01	10·24	3 6	90 G	18	48	31	*6	D-C.	6	V. Cp. Con.	2,075	British T-H.
SOUTHEND PIER (1) Southend Corp.	Aug., 1890	1·25	1·25	3 6	60 G	Lev.	..	25	..	..	..	..	..	British T-H.
SOUTH METROPOLITAN Elec. Try. Co.	Feb., 1906	13·09	26	4 8½	95 G	16	42	51	*8	..	6	Stm Tbs	1,650	Dick, Kerr & Co. Brush Co.
SOUTHPORT Corporation	July, 1900	13·5	20	4 8½	87 & 90 G	25	45	26	*3	D-C.	3	H. Cp.	600	Dick, Kerr, & Co.
SOUTHPORT Electric Tramway Co...	July, 1901	8·17	12·52	4 8½	87 G	Nil	40	21	*					
SOUTHPORT PIER	1905	1	1	4 0	..	..	..	3	..	..	..	..	..	Westinghouse
SOUTH SHIELDS Corporation ..	March, 1906	5·7	10·21	4 8½	95 G	15	35	35	2	D-C.	2	V. Cp. C.	1,100	Dick, Kerr & Co.
SOUTH STAFFORDSHIRE	Jan., 1893	18·98	29·5	3 6	97 & 90 G	17	46	46	3	R.	3	C.H. Cp.	..	Blackwell & Co. E. C. C
STALYBRIDGE, HYDE, MOSSLEY, and DUKINFIELD	May, 1904	23·75	27·75	4 8½	99 G	9	27½	60	9	.. ..	3 2	Marine Stm. tur.	7,900	Dick, Kerr, & Co.
STOCKPORT Corporation	Aug., 1901	16	27·54	4 8½	96 G	10·8	35	50	*5	D-C.	5	Cp.	1,000	Macartney & Co. Dick, Kerr, & Co.
SUNDERLAND Corporation	Aug., 1900	10·92	20·35	4 8½	96 G	12	36	70	*4	D-C.	4	..	936	Dick, Kerr, & Co.
SUNDERLAND District Electric Trys.	June, 1905	14·27	15·97	4 8½	90 G	11	40	33	*					
SUTTON & HOWTH (G.N.R., Ireland)	June, 1901	5·3	6	5 3	72 B	16·7	300	11	3	D-C.	3	V. Cp.	500	British T-H. Westinghouse
SWANSEA Tramways Company ..	June, 1900	12·43	18·54	4 8½	84 & 86 G	14	45	65	3	D-C.	3	H. Cp. C.	620	British T-H.
SWINDON Corporation	Sept., 1904	3·7	4·4	3 6	105 G	15	37	12	5	..	4	..	600	Dick, Kerr & Co.
TAUNTON ELECTRIC TRACTION CO.	Aug., 1901	1·66	2	3 6	90 G	25	35	6	*	..	..	..	..	Blackwell & Co.
TORQUAY Tramways	April, 1907	6·95	11·125	3 6	90 G	12	45	18	*2	..	1	..	..	
TRAFFORD PARK Estates, Ltd. (Trys.)	July, 1903	2·5	2·75	4 8½	100 G	Nil	35	7	4	D.C.	4	TandCp.	..	Westinghouse
TYNEMOUTH and DISTRICT	March, 1901	4·21	7·83	3 6	90 G	10	30	21	*3	D-C.	3	..	..	Blackwell & Co.
TYNESIDE Tramways & Tramroads Co.	Sept., 1902	10·97	16·23	4 8½	95 G	10	40	24	*					
WAKEFIELD & DISTRICT Lgt. Rlys. Co.	Aug., 1904	24·69	40·382	4 8½	96 G	15·5	40	69	5	D-C.	5	..	1,200	Dick, Kerr, & Co.
WALLASEY Corporation	March, 1902	8·75	19·86	4 8½	98 G	14	40	55	*3	D-C.	3	V. Cp. C.	1,100	Lanc. Dynamo Co. Blackwell & Co.
WALSALL Corporation	Jan., 1904	13·5	17·39	3 6	90 & 92 G	18·5	32	32	*8	D-C.	8	V. Cp. C.	1,730	British T-H. Electric Cons. Co.
WALTHAMSTOW U.D.C. Light Rly...	June, 1905	9·14	12·53	4 8½	100 G	18	40	38	*15	D-C.	15	Gas	1,560	Westinghouse Henleys, W. T.
WALTON-ON-NAZE PIER	Aug., 1898	·5	·5	3 6	36 V	..	..	3	3	D-C.	2	..	100	Blackwell & Co.
WARRINGTON Corporation	April, 1902	6·5	9·6	4 8½	90 G	27	50	21	*6	D-C.	6	V.C.	500	British T-H.
WEMYSS and DISTRICT	Aug., 1906	7·5	9	3 6	95 & 97 G	18	85	17	3	D-C.	3	2 V. Cp.	..	Bruce Peebles & Co Bruce Peebles & Co Brush Co.
WEST BROMWICH Corporation ..	Dec., 1902	7	12·5	3 6	98 G	20	49	29	8	D-C.	8	Turb'nes	750	Dick, Kerr, & Co. B. I. W. Co.
WEST HAM Corporation	Feb., 1904	15·5	27·75	4 8½	100 G	18	40	118	*3	D-C.	3	V.C.Cp.	1,500	Brush Co.
WESTON-SUPER-MARE	May, 1902	2·39	3·5	4 8½	90 G	25	40	12	5	D-C.	4	Cp.	..	Blackwell & Co. British T-H. Brush Co.
WIGAN Corporation	Jan., 1901	30·9	34·02	3 6 4 8½	105 G	12	45	67	*8	..	8	..	746	Blackwell & Co.
WOLVERHAMPTON Corporation (3) ..	April, 1902	13·5	21·5	3 6	91 G	15	37·5	49	*10	D-C.	10	H.&V.C. & Turb's	2,900	British T-H. Electric Cons. Co.
WOLVERHAMPTON DISTRICT	April, 1900	14·75	19	3 6	90 G	20	40	30	*4	..	..	..	..	B.I.W. & B.T-H. Westinghouse
WORCESTER Electric Traction Co. ..	Feb., 1904	5·86	8·58	3 6	94 G	13	45	15	*3	..	3		..	Brush Co. Dick, Kerr, & Co.
WREXHAM and DISTRICT	April, 1903	4·44	6·16	3 6	96 G	9·11	50	10	*6	..	..	..	..	British T-H. Brush Co.
YARMOUTH Corporation	June, 1902	10	14·6	3 6	90 & 95 G	27	48	35	3	..	3	Comp.	..	Brush Co. B.I.W. Co.
YORK Corporation	Jan., 1910	6	9·9	3 6	100	18	40	18	*8	D-C.	8	V.C.	..	Dick, Kerr, & Co. Brush Co.
YORKSHIRE WOOLLEN DISTRICT ..	Feb., 1903	22·25	36	4 8½	94 & 100 G	8	30	69	*	..	..	..	..	Brush Co. Dick, Kerr, & Co.
RAILWAYS.														
LONDON AND VICINITY:														
CENTRAL LONDON RLY. CO. (1) ..	July, 1900	6·5	13	4 8½	100 V	30	..	68 M. 172 T.	6	D-C.	6	H. Cp. C.	..	British T-H.
CITY & SOUTH LONDON RLY. CO. (1)	Dec., 1890	7·25	14·75	4 8½	60 V 80 V	30	120	52 L. 142 T	7	D-C.	7	2 H.C. 4 V.C.	..	Mather & Platt Elec. Cons. Co British T-H.
EAST LONDON RAILWAY (2) ..	April, 1913	5·75	11·5	4 8½	90 B	..	..	(c)	..	..	..	..	..	
GT. NORTHERN & CITY RLY. CO. (2)	Feb., 1904	3·5	7·75	4 8½	85 V	52	660	35 M 45 T	6	D-C.	8	V.Cp.C.	..	British T-H.
GREAT WESTERN RAILWAY .. (Hammersmith and City line.)	Nov., 1906	4·9	10·5	4 8½	97½ B	60	400	40 M. 80 T	10	D-C.	10	V.Cp.	..	British T-H. Elec. Con. Co. Bruce Peebles
LONDON, BRIGHTON, and SOUTH COAST RAILWAY (4)	Dec., 1909	22	70	4 8½	..	..	..	16 M. 8 T.	(d)	..	..	..	..	Allgemeine El. Ges British T-H. Blackwell & Co.
LONDON ELECTRIC RAILWAY CO.: BAKER ST. & WATERLOO RY. (2)	March, 1906	4·25	8·5	4 8½	90 B	60	330	36 M. 72 T.	(a)	..	..	..	..	Westinghouse British T-H.
CHARING CROSS—HAMPSTEAD RAILWAY (2)	June, 1907	8	16·5	4 8½	90 B	33	330	60 M. 90 T.	(a)	..	..	..	..	Westinghouse British T-H.
GREAT NORTHERN, PICCADILLY & BROMPTON RLY. (2)	Dec., 1906	9·25	18·5	4 8½	90 B	33	330	72 M. 144 T.	(a)	..	..	..	..	Westinghouse British T-H.
METROPOLITAN RAILWAY (2) ..	Jan., 1905	26	59	4 8½	86 B	44	363	86 M. 172 T.	4	D-C.	4	Turbine	..	Westinghouse British T-H.
METROPOLITAN DISTRICT RAILWAY (and running powers) (2)	July, 1905	41	80·46	4 8½	86 B	40	330	284 M. 286 T.	(a)	..	..	..	..	British T-H. Westinghouse
WATERLOO AND CITY RLY. CO. (1)	Aug., 1898	1·5	3	4 8½	87 B	30	321	17 M. 12 T.	6	D-C.	6	V. C.	..	Siemens Bros. Dick, Kerr & Co.
PROVINCES:														
LANCASHIRE AND YORKSHIRE (2).. (Extension on 3,000 volt. D.C. system in	March, 1904 progress)	31	65	4 8½	86 B	85	840	38 M. 52 T.	6	D-C.	5	1 V.C. 4 H.C.	..	Dick, Kerr, & Co.
LIVERPOOL OVERHEAD RLY. CO. (1)	March, 1893	6·5	13·05	4 8½	60 V	40	429	46 M 7 T	7	R.&D-C	7	H.Cp. V.Cp.		Electric Cons. Co. Dick, Kerr, & Co.
MERSEY RAILWAY (1)	April, 1903	4·5	9	4 8½	86 B	27	528	24 M. 37 T.	5	D-C.	5	V.Cp.	..	Westinghouse Elec. & Mfg. Co.
MIDLAND RLY.—MORECAMBE AND HEYSHAM BRANCH (4)	June, 1908	9·75	19·5	4 8½	..	..	..	8 M. 6 T.	4	D-C.	4	Gas.	..	Westinghouse Siemens Bros.
NORTH EASTERN RAILWAY (1) ..	March, 1904	35	80	4 8½	90 B	55	792	60 M. 50 T.	(b)	..	..	..	..	British T-H. Co.

* Power from combined lighting and power station. (1) Third rail system. (2) Third and fourth rails system. (3) Lorain surface contact system. (4) Single phase.
(a) Power supplied by Chelsea Power Station (80,000 H.P.) (b) Power purchased from the Newcastle-upon-Tyne Electric Supply Company, Limited.
(c) Rolling stock supplied by Metropolitan Railway. (d) Power supplied by London Electric Supply Corporation. M—Motor Cars. T—Trail Cars.

PRESCOT LINE INSULATORS



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Thoroughly homogeneous and non-hygroscopic.
Free from sand, slate, or flake mica.
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Hard, but not brittle.
Does not soften at 250° Fah.
Every piece tested to withstand an alternate current of 2,500 volts after 24 hours' immersion in water.

Nephroin Insulation is in general use on most of the tramways in the United Kingdom, and is also largely used in Africa, Argentina, Australia, Burmah, Canada, China, India, New Zealand, Tasmania.

BRITISH INSULATED & HELSBY CABLES, LTD.

Electrical Cable Makers and Engineers.

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Automatic Brake Adjustment

ELIMINATES DEPENDING UPON THE HAND ADJUSTMENT.
KEEPS YOUR BRAKES ALWAYS RELIABLE AND SAFE.
SAVES SHOES AND CURRENT, AS IT PREVENTS SHOES DRAGGING ON WHEELS.
GOVERNS ANY PREDETERMINED TRAVEL OF THE LIVE LEVERS, AND PREVENTS LOSS OF LEVERAGE.
ELIMINATES RETURNING CARS TO DEPOT FOR READJUSTMENT.
GIVES A SAFETY TO YOUR BRAKES THAT CANNOT BE HAD IN ANY OTHER MANNER.

Read the following letter from a well-known Tramway Manager and Engineer:

Anger Improved Automatic Brake Adjuster,

CARDIFF CORPORATION TRAMWAYS.

THE HAYES,
CARDIFF, *7th May, 1913.*

Messrs. THE ANGER MANUFACTURING & SUPPLY CO., LTD.,
BANK CHAMBERS,
PRESTON, LANCS.

DEAR SIR,—In reply to your enquiry this morning I would say that we are entirely satisfied with the Automatic Brake Adjusters which you fitted some time ago to one of our cars for trial purposes. These adjusters have been in operation now since November 22nd to date, and have not given us the slightest trouble. We are of opinion that by generally adopting them on all our cars we should obtain better results in every respect. In the first place we should be able to do away with a great amount of work that is now necessary in the inspection of brake blocks from the point of view of adjustment of such only, the brake fitters being better engaged in renewing blocks that are worn out. By having brake blocks automatically adjusted we have ascertained, by the experience that we have so far had, that the number of cars returned to the depôt for brake troubles for the want of adjustment would be almost entirely eliminated; the consumption of Electrical Energy per car mile would be considerably reduced, over and above substantial reductions that we have already obtained by having meters on our cars.

The particular car to which the adjusters have been fitted has now run 10,383 miles without the slighest trouble. We have worn out on this car two sets of brake blocks, owing to the very wet weather we have experienced during the past few months, and further to the blocks being of somewhat softer material than usual. We anticipate, however, that with the new blocks we propose using in the future we shall get still better results. At any rate I may say that even on this car alone, had we not had the adjusters fitted, we should have used more blocks than we have done, but the actual cost of the blocks themselves, in our opinion, is not everything to be considered. By having the cars continually in service, and running satisfactorily without brake troubles, we save the loss in time that is often necessary in returning a car to the depôt, and incidentally the loss of revenue.

As already mentioned, we are thoroughly satisfied with the operation of these adjusters, and in course of time propose fitting the same to the whole of our cars, 130 in number.

Briefly, we anticipate by adopting them throughout our cars reducing labour, consumption of energy, and cost of brake blocks.

Yours faithfully,
(signed) ARTHUR ELLIS, *Manager.*

Suitable for either Single or Bogie Trucks, and with Any Type Platform Brake Gear.

We can show you many letters like the above from Tramways in all parts of the World.

THIS DEVICE IS IN USE IN OVER 50 SYSTEMS IN ENGLAND,
AND IN OVER 75 SYSTEMS IN FOREIGN COUNTRIES.

Repeat orders from Salford, Manchester, Sheffield, Preston, Blackpool, East London, Huddersfield, Hastings, East Ham, Dundee, Aberdeen, Wolverhampton, Walsall, etc., etc.

Also ORDERS in hand for 100 for SHEFFIELD,
100 „ BIRMINGHAM,
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10 „ MANCHESTER,
10 „ SALFORD.

LET US TELL YOU MORE ABOUT THIS DEVICE.

The Anger Manufacturing & Supply Company, Ltd.,

— MANUFACTURERS —
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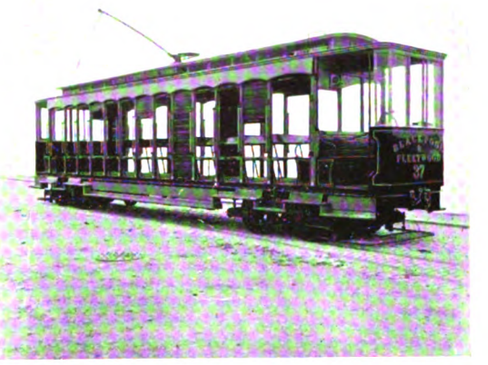
THE UNITED ELECTRIC CAR CO., LTD.

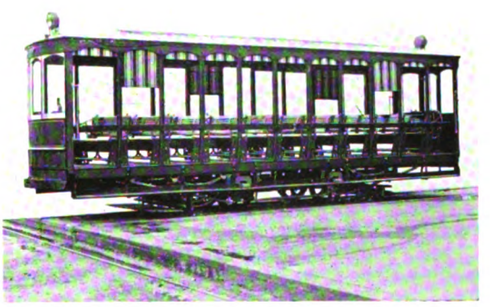
WORKS, PRESTON.

THE following are some of the many types of Open Cars we have built for various Tramways.

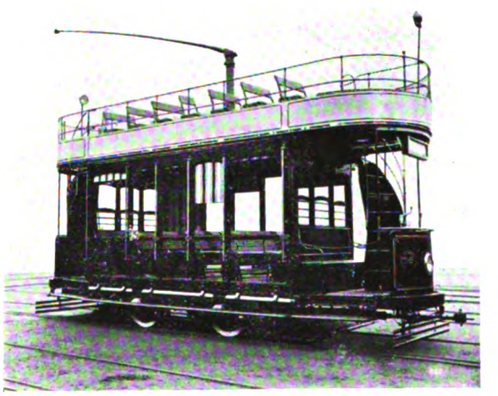
This is the Open Car which has been such a success financially on the Blackpool Tramways. It is specially suitable either for Seaside Tramways, or for pleasure routes in the country.



This is a similar type of Car, but covered, as supplied to the Blackpool and Fleetwood Tramroad Co. The sides can be closed by roller shutters.



A Single-Truck Vestibuled Open Car which could be used either as a Motor or Trailer Car.



A Top-Seat Open Car suitable for Seaside and Country routes.

Kindly send us your enquiries for Seats, Blinds, Blind Materials, Route Indicators, Sand Boxes, Spares for Trucks, and Spare Parts for Car Bodies.

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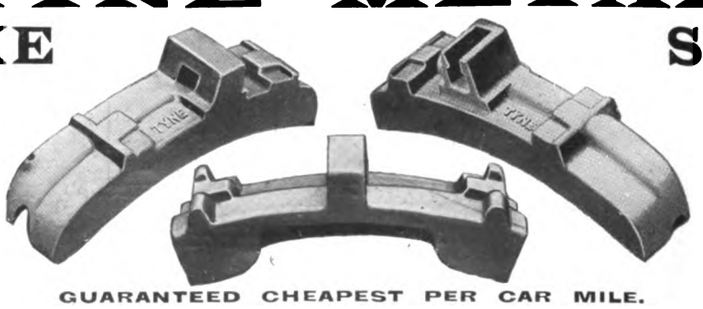

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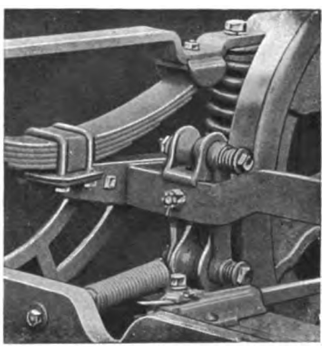

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JUST a pair of hanger forgings with half-ball ends, fitting snugly into sockets, and held in tension by a special spring on a bolt. Simple—fewest possible number of parts. Vibration and jolting fail to disturb their relation; cannot work or shake loose; result—a noiseless glide to and fro. This hanger has a record of over four years' service without changes or renewals. Now made practically indestructible by case-hardening the half-balls. The spring automatically adjusts the hanger for any slight wear. Torsional movement on curves specially provided for—shoe hangs free of the wheel on curves. Highly efficient—*silent*—durable.

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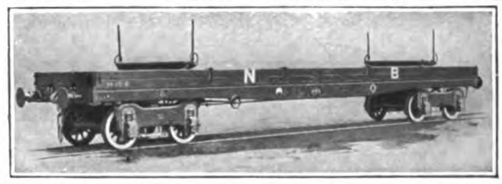

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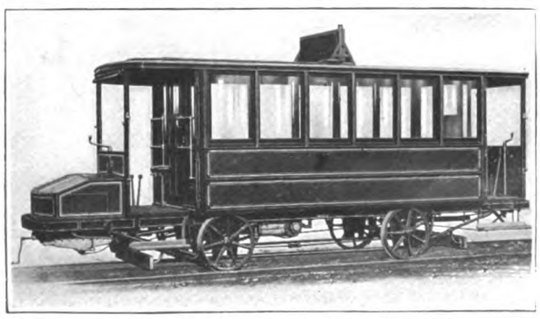

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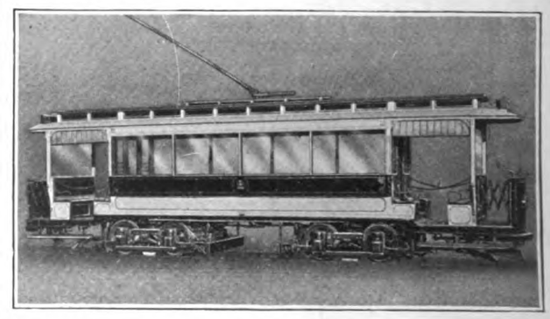

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If a car receives a **bent dash** as the result of a **collision,** what happens to your geared brake? It will probably be thrown out of action, due to the gears binding—the natural result if the pinion is keyed on to the spindle. The Ackley Brake is designed to overcome this danger. The gear and pinion being contained in a common frame, the latter is not dependent in any way upon the spindle for its bearing. **It is the only geared brake with this valuable and essential feature.**

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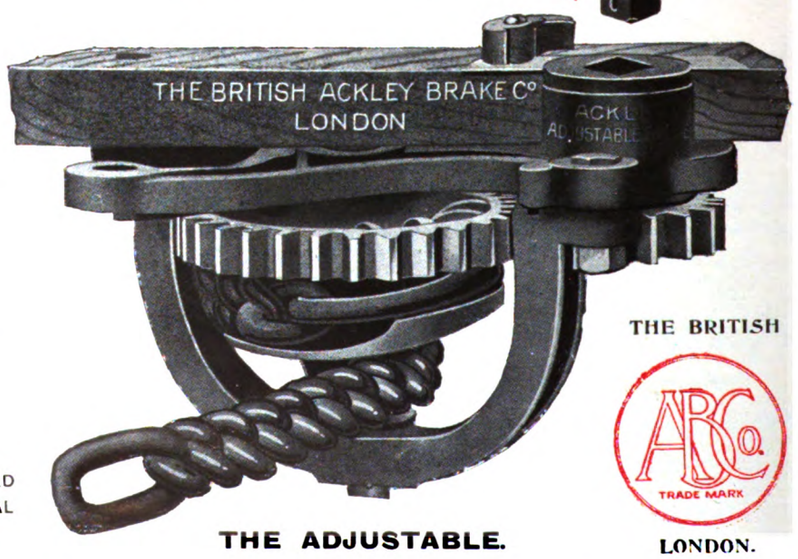

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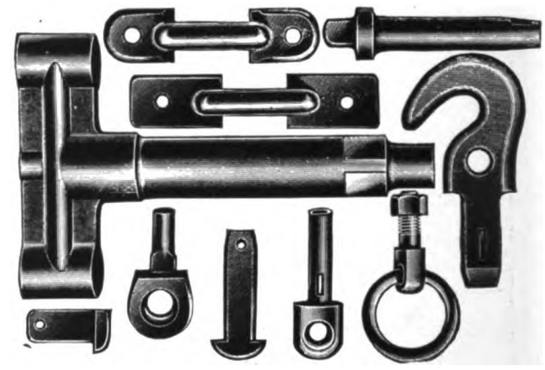

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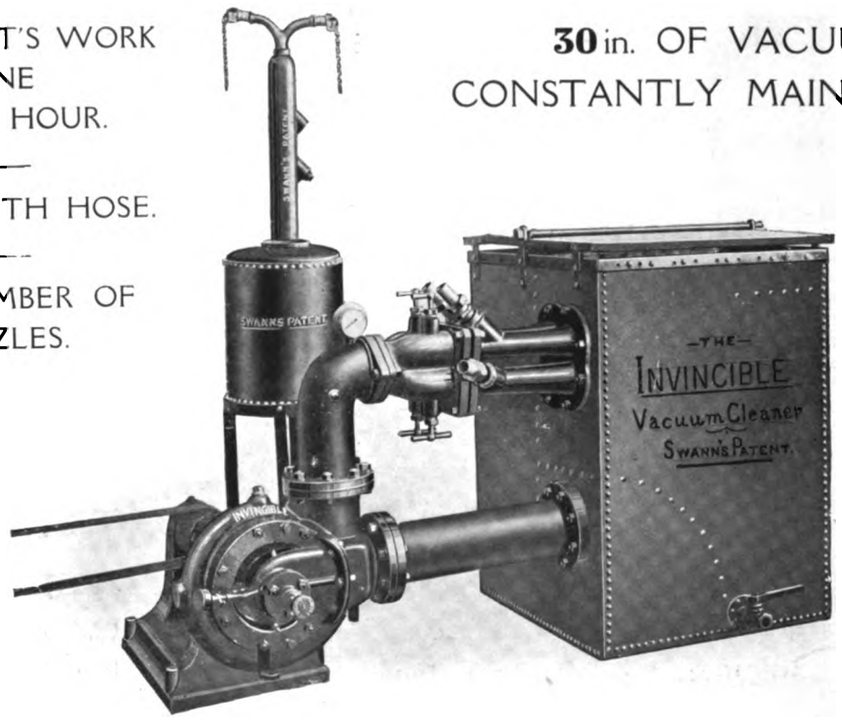

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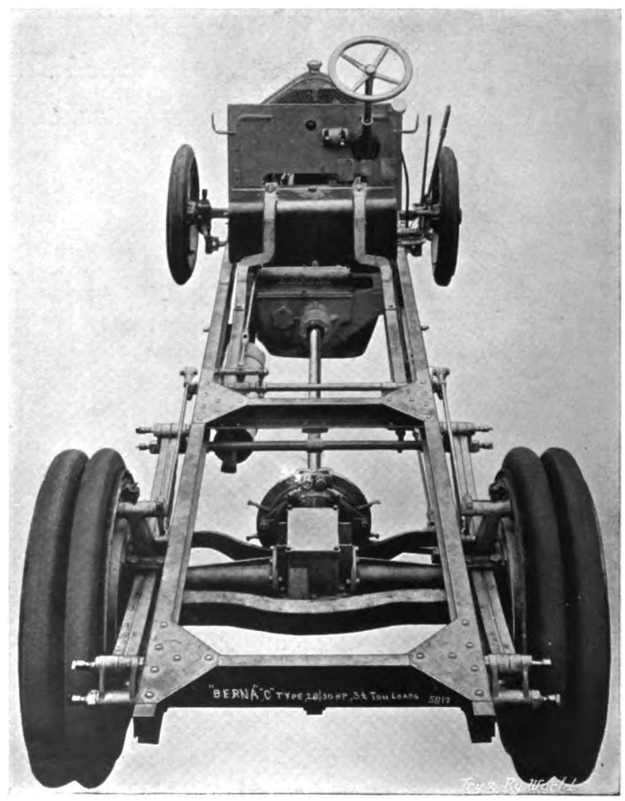

Berna 3½-Ton Chassis. Rear View Showing Differential and General Arrangement.

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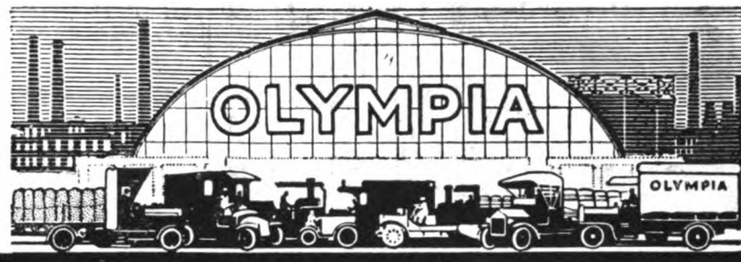
JULY 18TH-26TH 1913
OLYMPIA.



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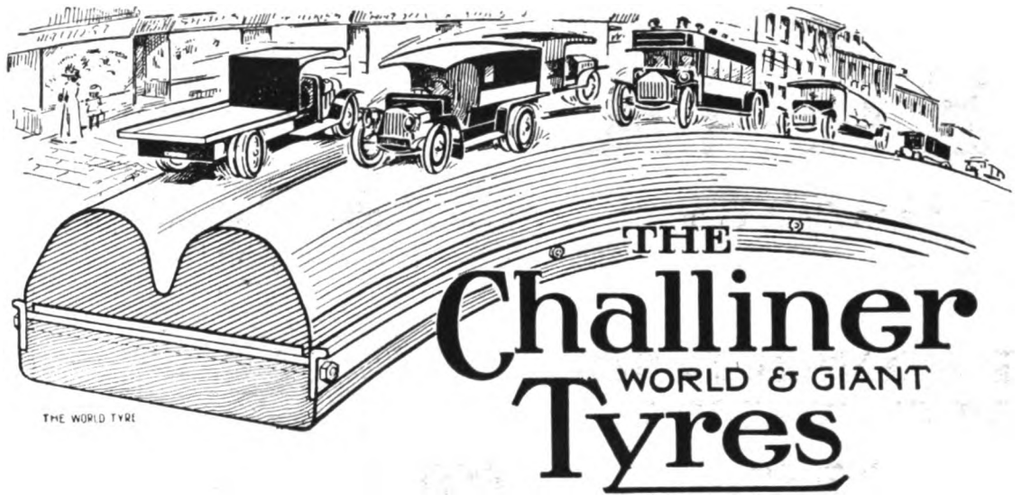

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Manchester: 190, Deansgate.
Leeds: 115, Albion Street.
Newcastle-on-Tyne: 2, St. Nicholas Buildings, St. Nicholas Street.
Glasgow: 63, Bath Street.
Bristol: 35, Victoria Street.
Dublin: Oriel House, Westland Row.
Belfast: 41, Chichester Street.

Solid Tyres can be obtained from any of the above depots, and fitted to customers' wheels free of charge.

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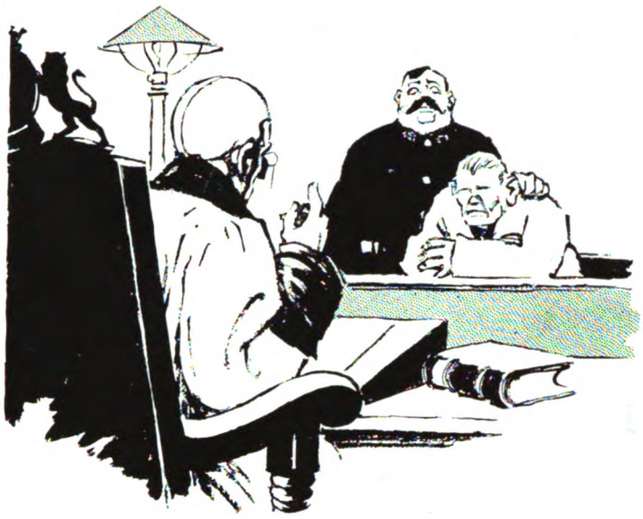

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AVON SOLID BAND TYRES

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We ask nothing more than that you should try them and judge them on their merits.

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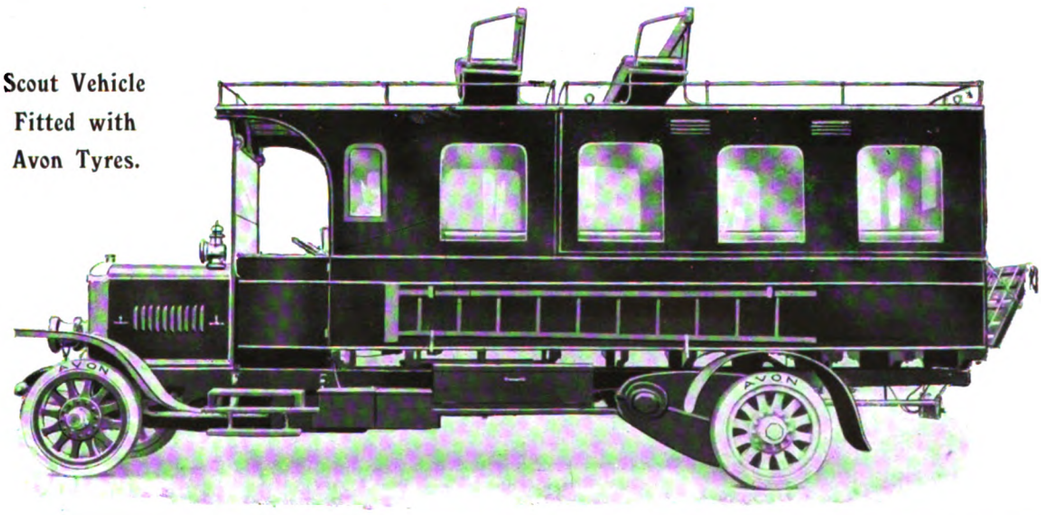

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SAVE 20%
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Specially Designed for Heavy Vibration and Heavy Overloads.

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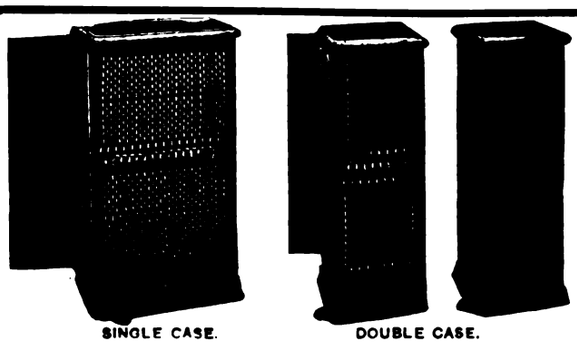

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Made in TEN PATTERNS for all purposes.

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AUTOMATIC REVERSIBLE BOOSTERS.

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No matter in what language, or in what form you want your tickets printed—we can give you good service. Make a point of asking us for prices and samples.

We hold contracts for ticket printing from some of the largest tramway undertakings in the world. We are giving them every satisfaction. We can give you every satisfaction.

Glasgow tickets are distinguished by being well printed on paper or good pulp; they are accurately numbered, and well finished.

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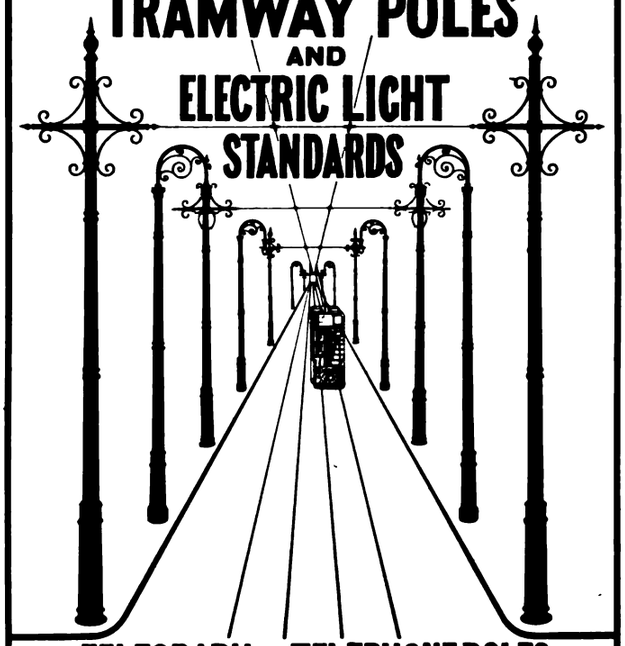

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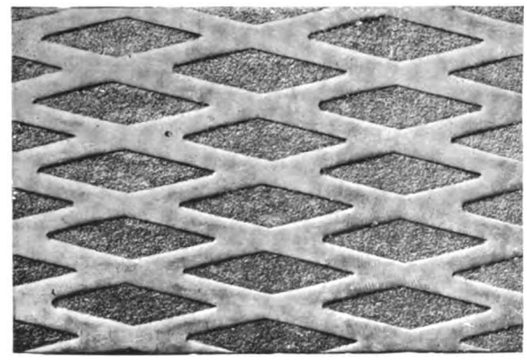

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Clean,
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FOR TRAMWAYS, MOTOR 'BUSES, etc.,

are the best for an adequate and reliable check on Traffic Receipts. The price is moderate and Repairs are reduced to a minimum. Thousands in use with leading Corporations and Companies.

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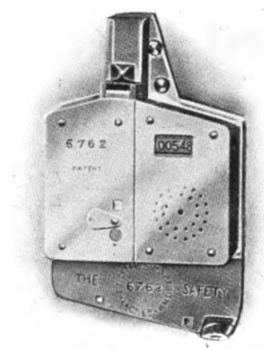

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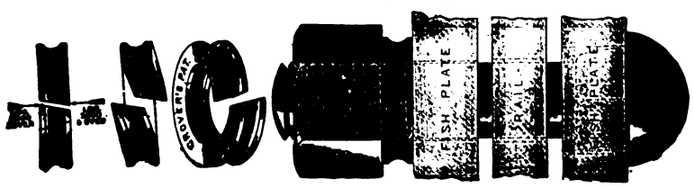
Made in all Sizes for Bolts from ⅜ in. to 4 in. diameter.



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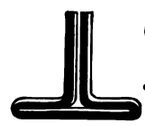

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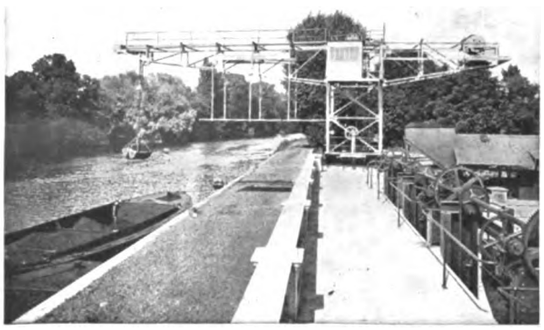

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UP TO 4,000 CANDLE POWER.

For ENGINEERS, CONTRACTORS, DOCKS, RAILWAYS, Etc.

OVER 18,000 SOLD.

Adopted by 26 Governments. Supplied to 500 British and Foreign Railways and all Leading Firms.

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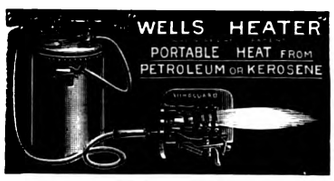
Burn Kerosene or Petroleum in Foreign Countries; in Great Britain our Special Wells' Oil is supplied.



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This Lamp is very simple in construction. No skilled labour is required. It can be charged and put to work in five minutes, and will then run until the carbide is exhausted

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Light from Kerosene or Petroleum without Wick, at less than One Penny per hour.

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Perfect safety.
No explosive Naphtha used
Thousands sold.
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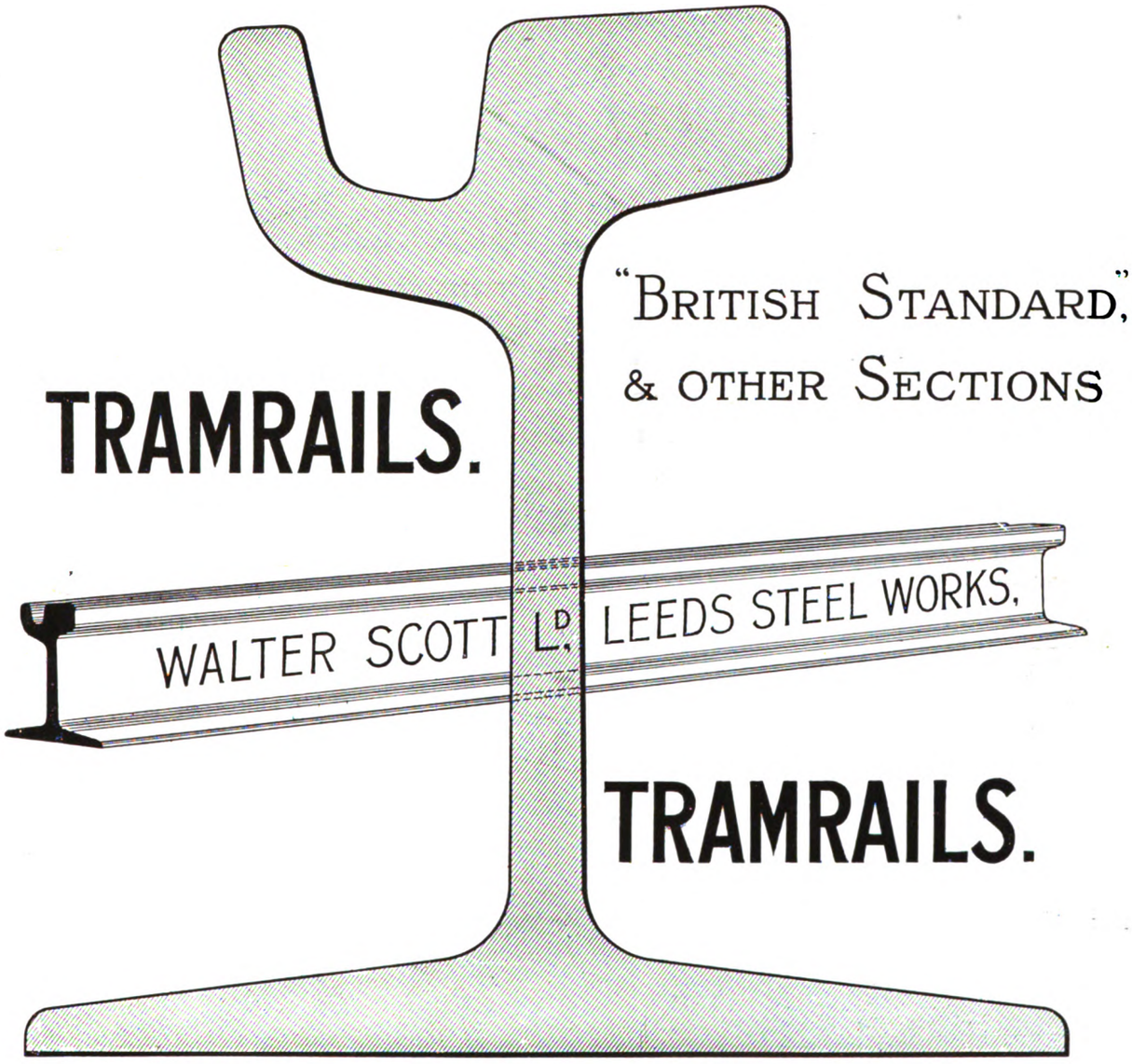

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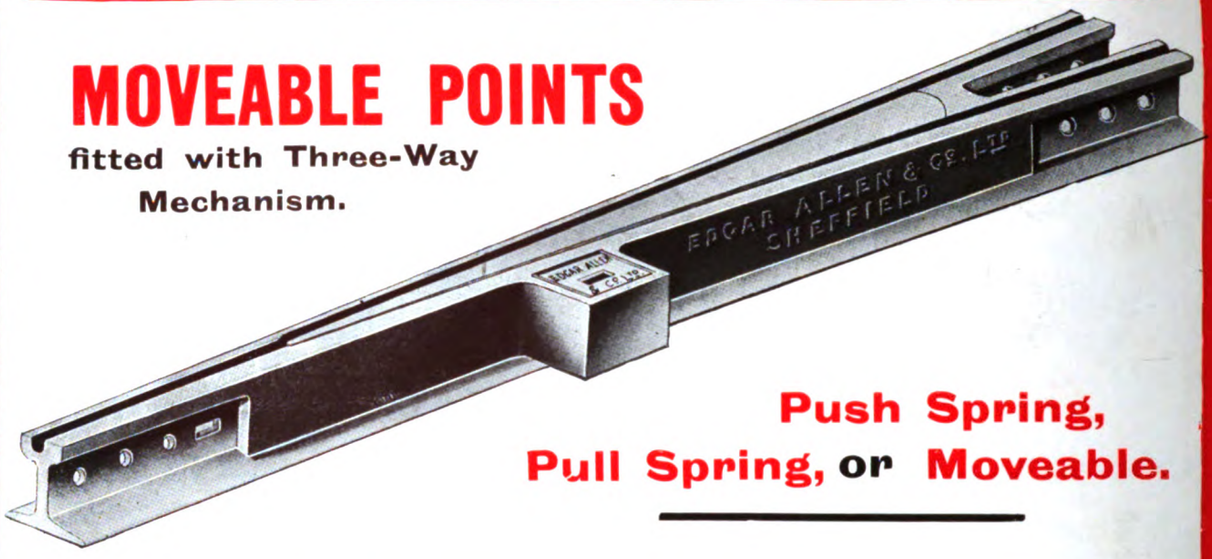

Push Spring,
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ROLLED IN

ALLEN'S IMPERIAL MANGANESE STEEL.

ALLEN'S IMPERIAL MANGANESE STEEL.

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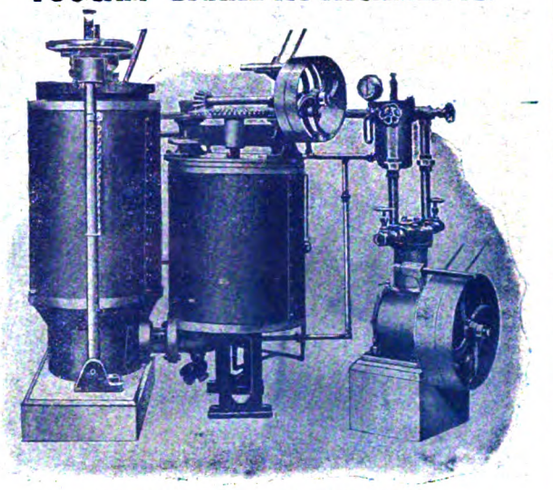

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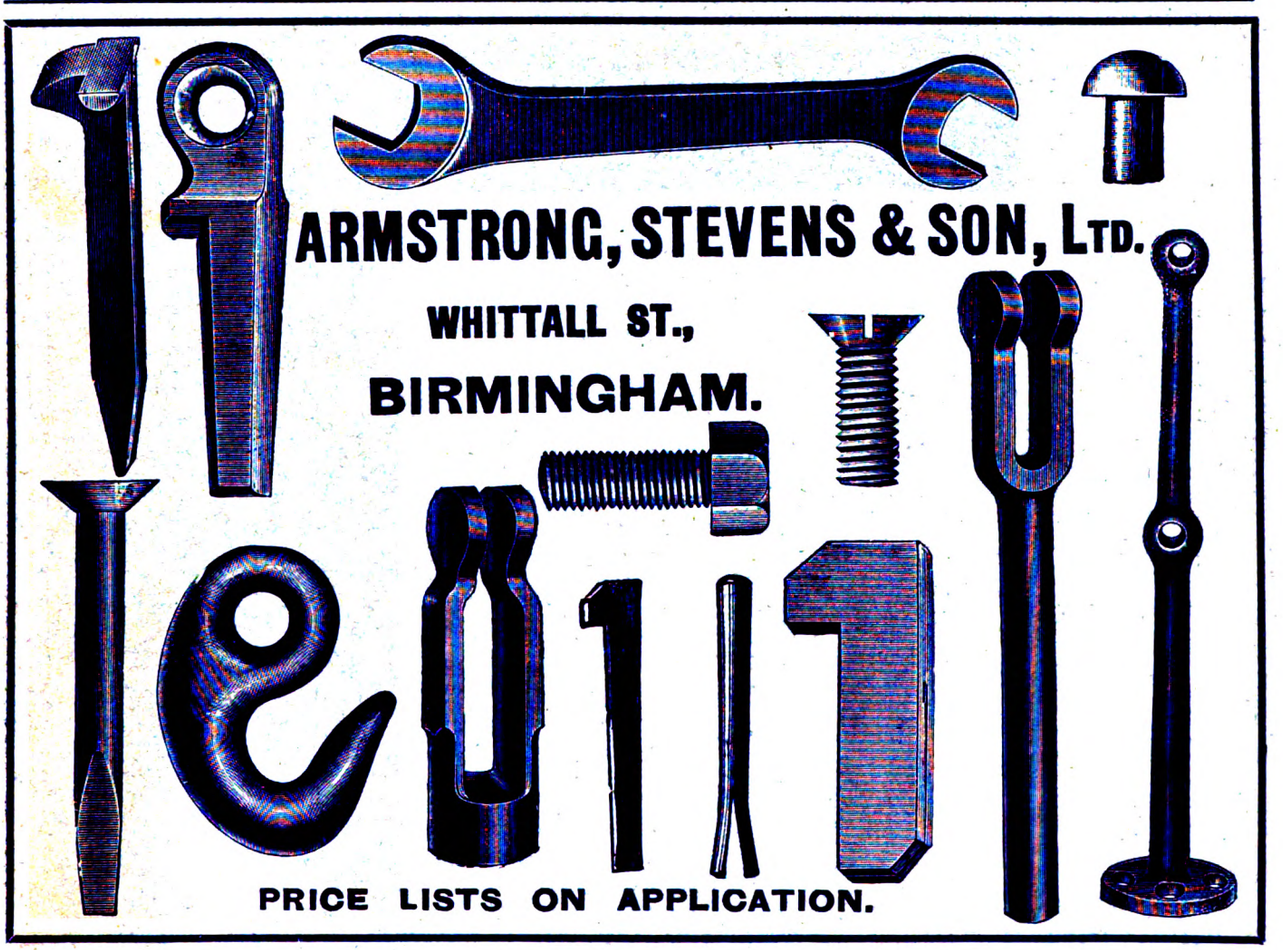

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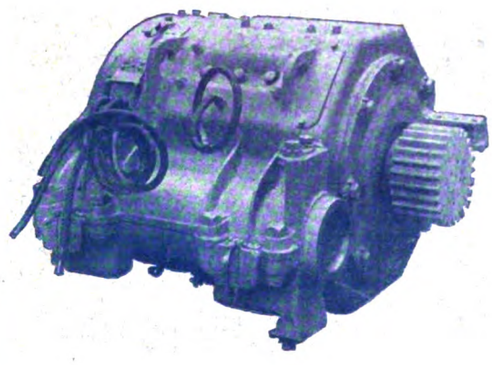

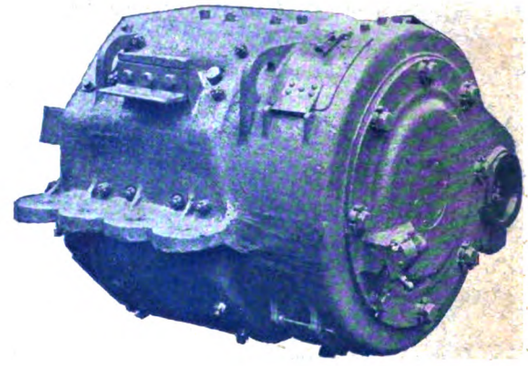

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